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Scouring, Baling, and Transporting WESTERN WOOLS

- Practices
- Problems
- Possibilities

Marketing Research Report No. 723
U.S. Department of Agriculture, Economic Research Service in cooperation with Farmer Cooperative Service

PREFACE

This study was conducted jointly by the Economic Research Service and the Farmer Cooperative Service and was recommended by the Transportation Research Advisory Committee to the Department of Agriculture.

The Economic Research Service had responsibility for assembling and analyzing economic data pertaining to an evaluation of wool scouring and baling in the producing areas and the preparation of this report. The information relating to transportation and traffic flow was assembled and analyzed by the Texas Transportation Institute with contract funds provided by the Farmer Cooperative Service.

L. D. Howell, formerly with Economic Research Service, and Walter L. Hodde, formerly with Farmer Cooperative Service, contributed to planning of the research. Special credit is also due Robert J. Byrne, Farmer Cooperative Service, who assisted in planning the research and who was the Department's designated representative in developing the contract with the Texas Transportation Institute.

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SUMMARY AND CONCLUSIONS

Results of this study indicate that transportation costs for moving Western wools to the mills can be reduced. Installation of permanent baling facilities for grease wool appears advisable except in the smallest warehouses. Scouring Western wools locally does not appear advisable unless the scouring is performed to specification for established trade interests.

Transportation charges are one of the largest cost items in marketing raw wool. Domestic wool production is concentrated west of the Mississippi River, primarily in 11 Western States and Texas, but the scouring and processing industry is located along the East Coast. Most of the 230 million pounds or so of grease wool produced annually in the United States is transported in bulky bags, unscoured, to Eastern wool manufacturing centers for preparing, blending, scouring, and processing. The location and structure of the wool production and processing industries are changing. The implications of these changes are directly related to potential transportation benefits from baling and scouring in the producing area.

The 23.3 million head of stock sheep on farms and ranches in 1965 is a record low. Sheep numbers have dropped more sharply in the West since World War II than they have in the East. However, the 11 Western States and Texas still account for two-thirds of our shorn wool production.

New England is still the most important wool processing region, but woolen and worsted manufacturing operations are moving south. Southern mills are primarily branch plants of national firms and, on the average, are larger than New England mills and considerably larger than those in the Middle Atlantic States. However, few scouring facilities have been constructed in the South. As a result, large volumes of grease wool are shipped from the West to New England and the Middle Atlantic States for scouring, and then reshipped to the South for processing into yarns and fabrics. Western commission scourers have located plants in Texas and the lower Rocky Mountains to try to intercept these shipments.

Historically, railroads have had a near monopoly on long shipments of grease wool from the producing areas to the mills. But by baling wool prior to shipment, motor carriers can load a sufficient weight to make their rates competitive with railroads. Texas trucking firms started the recent surge toward baling grease wool when they developed portable balers in the late 1950's. Between the late 1950's and 1963, the railroads lost nearly the entire amount of wool shipments from Texas and eastern New Mexico. To regain this lost traffic, in late 1963 the railroads reduced their rates by about 40 percent on wool and mohair shipments from the Southwest. Carriers in Western Trunk Line Territory have twice refused to do this on the theory that there is as yet no serious truck competition. Apparently these carriers feel that there must be substantial diversion of traffic to motor carriers before they will consider rate reduction.

The high concentration of relatively small wool warehouses in Texas is conducive to the use of motor-carrier or other portable facilities for baling. The small annual volume of wool may not justify the installation of permanent baling facilities. But circumstances are different in the 11 Western States. Warehouses are widely scattered and generally handle a much larger volume. Also, about one-fourth of the Western warehouses are cooperatives where grading is common. Under

these conditions, installation of permanent baling facilities offers many advantages and appears feasible in all but the smallest. In addition to probable transportation benefits, handling and storage costs will be reduced and drawing samples for yield determinations (coretesting) can be done faster, cheaper, and apparently more accurately. A few of the Western wool warehouses have installed balers and if this practice expands, as appears likely, the proportion of the wool marketing dollar going to transportation will decrease.

Costs are higher for baling fleeces than for baling bags although the same type and size of baler may be used. Baling fleeces requires bale covers and usually a conveyor and "hopper" in addition to the baler and clamp-lift truck. The necessary equipment including transportation and installation for baling fleeces would cost about $14,750, and for baling bagged wool, about $13,600. The average cost of baling at a warehouse that bales 2.5 million pounds annually is estimated at 30 cents per 100 pounds of fleece wool, 16 cents for bagged wool.

The feasibility of scouring wools in the producing areas is questionable. Certainly there are possible transportation benefits which could even exceed those realized from baling grease wool, and the cost of scouring may be less in the West than in the East. However, there may be distinct disadvantages, depending upon who owns the wool when it is scoured and who will process it. Wool varies widely in grade, staple, and other quality factors. For example, more than 1,000 "types" of wool have been noted and described in Australia alone. The problem facing the mills is to match the most suitable type or types of wool, with any number of end products and manufacturing variables.

Wool may be processed on either the woolen or worsted system, depending largely on staple length. Most of the wool produced in the West and Texas has sufficient length for the worsted system.

Members of the wool trade have long maintained that scouring wools for growers, wool dealers, and other nonprocessors may limit the market outlets for these wools, regardless of length, to woolen manufacturers--nearly always a lower priced market. This is because processing requirements for worsteds are particularly rigid, and once wools are scoured it is extremely difficult to evaluate their various quality characteristics and to determine, among other things, how efficiently they will comb. For these reasons, topmakers and worsted manufacturers buy grease wool almost exclusively.

The history of Western wool scouring and the relatively small, but apparently successful, present industry provide some important guidelines. It is not generally advisable to depend either on grower accounts for commission scouring or on purchasing grease wool for scouring and resale. In the near absence of a Western mill industry with which to affiliate, commission scouring for Eastern trade interests appears most feasible. Those Western plants which have concentrated on these accounts have apparently had considerable success. This method of operation solves the wool scourers' procurement and marketing problems because the dealers, topmakers, and mills furnish along with the wool all pertinent instructions for preparing, blending, scouring, and shipping. The problem that remains is to solicit sufficient accounts from these sources to justify a scouring plant.

An efficient scouring operation, utilizing 1 train (60 inches wide), would require about 10 million pounds of grease wool annually. The necessary equipment (new)--including a grease recovery unit, forklift, and baler--and transportation and installation cost would require about $220,000. In addition, a minimum of 32,500 square feet of floor space for the scouring operation and for warehousing is required. The average cost of scouring 100 pounds of grease wool in 1964 in a commission plant processing 10 million pounds annually is estimated at $2.36, exclusive of local, State, or Federal taxes. Costs of the various inputs will, of course, differ among locations.

SCOURING, BALING, AND TRANSPORTING WESTERN WOOLS
Practices, Problems, Possibilities

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I. INTRODUCTION

Transportation charges represent one of the largest cost items in the marketing of raw wool. Domestic wool production is concentrated west of the Mississippi River, primarily in the 11 Western States and Texas, but the wool scouring and processing industry is located along the East Coast. Baling and scouring wool in the producing area may greatly reduce the transportation cost and facilitate handling and storage. Distance and weight are the 2 main factors affecting transportation charges.

The domestic wool clip has traditionally been marketed and transported in bulky bags, which are generally "packed" manually at the farms, ranches, and warehouses. The concept of baling the grease or scoured wool to facilitate heavier loadings, thus decreasing the costs per pound for transportation and reducing marketing costs, is not new. California wool growers tried baling grease wool as early as 1912. But this and subsequent efforts met with little success, primarily because of Interstate Commerce Commission (ICC) regulations and the contention by the wool trade that baling was detrimental to the wool fiber.

Wool as shorn from the sheep is called "grease wool" and usually contains about 50 percent and sometimes as much as 80 percent of dirt, wool grease, and other impurities. Scouring the wool removes these impurities so that the fibers can be processed into apparel and other wool products. This is one of the most intricate and important operations in wool processing.

Most of the 230 million pounds or so of the annual U.S. grease wool production is transported unscoured to Eastern wool manufacturing centers for preparing, blending, scouring, and processing. Thus, millions of pounds of waste material are shipped across the United States each year at considerable expense. Wool growers, local chambers of commerce, industrial development groups, and others realizing this apparent opportunity to reduce marketing costs are constantly asking: "Why not scour our wools in the producing areas?"

Much has been said and written about the advantages of building scouring plants in the West, but relatively little consideration has been given to the following problems: The technical aspects of preparing, blending, and scouring operations; the potential supply of grease wool for particular sites; the market outlets for the scoured product; the capacity of the present wool scouring industry; or the reasons the present industry is concentrated along the East Coast. One notable exception was a pre-World War II article by the Department of

Agriculture which concluded that the major question was not whether the scouring could be done more economically in the West than in the East, but rather whether the scoured product would be acceptable to the then all-important manufacturers of worsted (2). Topmakers and worsted manufacturers reportedly could better meet the more rigid requirements of the combing operation by preparing and blending the grease wool to their own specifications prior to scouring.

Many of these limiting factors have changed, but the extent and stability of some of the changes is not clear. For example, the wool transportation picture has changed drastically since 1957, with significant changes in railroad minimums and the rate structure for wool. An increased proportion of the wool clip is being moved by truck (particularly to the Southeast), largely due to recent developments in baling grease and scoured wool in producing areas (13).

Topmakers and worsted manufacturers now utilize, at least to some extent, the limited wool scouring facilities in the producing areas. These developments tend to support industry research which indicates that long shipments of scoured baled wool do not significantly increase fiber breakage during subsequent carding and combing operations, thus decreasing the proportion of top obtained (21). Along with this, woolen manufacturing which does not require combing has become more important. The location of the wool processing industry is changing. The woolen and worsted industries have tended to move out of New England but have been slow in bringing their scouring operations with them.

The purpose of this study is to determine and evaluate the more important factors relating to wool scouring and baling in the producing areas, particularly the West, and to appraise the possibilities of reducing transportation and other marketing costs. To accomplish this necessitates (a) determining the major wool production areas and the quality and quantity of wool produced, (b) considering present and probable future locations of woolen and worsted manufacturers, (c) developing cost information on baling and scouring operations, (d) considering the response of the woolen and worsted industry to wool scoured and/or baled in producing areas, (e) developing methodology to estimate potential transportation benefits, and (f) evaluating the net effect of these factors.

The scope of this report is purposely broad. It is hoped that the methodology, guidelines, and suggestions developed will assist wool growers and their cooperatives and other marketing agencies, transportation agencies, local chambers of commerce, development groups, and others in evaluating the possibility of wool baling or the establishment of wool scouring facilities in their area.

Information for the study was obtained primarily through personal interviews. All known wool scouring plants and wool warehouses having baling equipment in the 11 Western States, South Dakota, and Texas in 1960 were visited. These 13 States account for most of our grease wool production and comprise the producing area to be analyzed in this study. Operators of 3 Eastern scouring plants also were interviewed. Transportation data were obtained from the scouring plant and wool baling warehouse operators, the pertinent transportation agencies, and the Interstate Commerce Commission (ICC). The information relating exclusively to transportation was assembled and analyzed by the Texas Transportation Institute under contract with the Farmer Cooperative Service, U.S. Department of Agriculture.

II. THE WOOL SUPPLY

Sheep numbers in the United States are at their lowest level since the 1850's. Although there are indications that the location and size of the producing units are undergoing some change, the major wool production areas are still in the West. The wools produced within these areas and the origin, quantity, and quality of those that are now being scoured at local Western plants are all important considerations of the "wool supply."

Trends in Domestic Sheep Production 1/

There have been significant changes in the size and composition of the wool producing industry since World War II, which, to a large extent, reflect the intensity of competitive pressures on domestic sheep producers. Recent changes in sheep population, production capacity, and producing units provide some insight into probable future trends in wool production. Detailed data on the present wool supply are presented in labor sections of this report.

Sheep Population

The domestic sheep population has declined rather sharply since World War II. The Korean conflict and other factors temporarily brought a modest reversal of this postwar trend, but in 1961, sheep numbers again started down. On January 1, 1965, total sheep population was estimated to be 26.7 million head, 22 percent below the average number during 1947-49 and 60 percent below the record number in 1942. Likewise, the 23.3 million head of stock sheep on farms and ranches in 1965 represent a record low.

A recent study of the sheep industry indicates that several factors have contributed to the general decline in total and stock sheep population that began in 1942. These include: (1) low returns and high risk from sheep, versus cattle, in many areas; (2) apparent inability to increase productivity relative to other agricultural activities; (3) scarcity of competent labor on ranches; and (4) uncertainties of future legislative action, e.g., tariff levels, wool incentive payments, and grazing allotments (17).

In addition to these changes in domestic sheep population, the period 1947-49 to 1965 also witnessed a shift in the relative importance of various sheep producing areas. This has been particularly pronounced in Texas, where stock-sheep numbers have decreased more than one-third since 1947-49 to 4.8 million head in 1964-65. Numbers of stock sheep decreased over 14 percent in the 11 Western States during this period. The Central and Eastern States also have shared in the total decline, stock sheep numbers dropping more than 13 percent since 1947-49 (table 1).

1/ Based mainly on: McKinsey and Company (17). (Underscored numbers in parentheses refer to items in Literature Cited, p. 97.)

Table 1.--Number of stock sheep and lambs on farms and ranches and percentage of change, by specified State, 1947-49 and 1964-65 1/

State	1947-49 2/		1964-65 3/		Percentage of change
	Sheep and lambs	Percentage of total	Sheep and lambs	Percentage of total	1947-49 to 1964-65
	Number	Percent	Number	Percent	Percent
Montana	1,829	6.2	1,424	6.0	-22.2
Idaho	1,086	3.7	926	3.9	-14.7
Wyoming	2,191	7.4	2,114	8.9	-3.6
Colorado	1,262	4.3	1,123	4.7	-11.0
New Mexico	1,408	4.7	997	4.2	-29.2
Arizona	427	1.5	471	2.0	+10.3
Utah	1,403	4.8	1,206	5.0	-14.0
Nevada	467	1.6	272	1.1	-41.8
Washington	312	1.1	265	1.1	-15.1
Oregon	726	2.5	656	2.8	-9.6
California	1,728	5.9	1,518	6.4	-12.2
Western region total	12,838	43.7	10,972	46.0	-14.5
Texas	7,294	24.8	4,838	20.3	-33.7
All other States	9,278	31.5	4/ 8,034	4/ 33.7	-13.4
U.S. total	29,410	100.0	23,844	100.0	-18.9

1/ Adapted from Wool Statistics and Related Data Through 1957 (34) and Livestock and Poultry Inventory, 1965 (32).
2/ 3-year average.
3/ 2-year average.
4/ Includes Alaska and Hawaii.

The decrease in Western sheep numbers has been particularly significant in Nevada, down nearly 42 percent; New Mexico, down 29 percent; and Montana, down 22 percent. In the West, only Arizona increased its stock sheep numbers during the last 15 years and this increase was small (table 1).

The geographic shifts in sheep population result from several contributing factors including: (1) relatively more favorable returns and production conditions found in diversified, farm-type operations; (2) low producer returns in range operations; (3) private and public demands for land for other purposes in certain geographic areas, particularly New Mexico and California; and (4) deterioration of range land in certain regions as a result of poor climatic conditions and overgrazing.

Production Capacity

While technically sheep can be produced under a variety of environmental and economic conditions, sheep population trends are to some extent related to production capacity, that is, availability of suitable land. Unfortunately,

current estimates are not available but estimates made by the Department of Agriculture in 1950 indicate that the optimum production capacity for sheep in the United States was between 37 and 40 million head (35). Thus, the 1965 population of 26.7 million represents between 67 and 72 percent of capacity. At present, however, McKinsey and Company (17) were of the opinion that fuller utilization of this potential capacity is unlikely due to the relatively weak demand for sheep products and the comparatively poor returns from sheep production.

At the same time, declines in availability of grazing land for sheep pose serious problems for producers in certain areas. While specific figures on total sheep grazing land are not available, 3 indicators point to a gradual decline. First, since 1947 there has been about a 12-percent reduction in the number of sheep permitted to graze on Federal lands administered by the U.S. Forest Service and the Bureau of Land Management. Lands administered by these 2 agencies make up about 25 percent of total grazing lands and are grazed by both sheep and cattle. Reductions in numbers of sheep grazed on public lands represent: (1) an effort by these 2 agencies to bring grazing use more nearly in line with estimated grazing capacity, (2) shifts from sheep to cattle production, and (3) a decline in demand for use of these lands by sheep producers. On many Federal ranges, present sheep numbers are believed to be in balance with the estimated grazing capacity but in some areas additional reductions in sheep numbers are undoubtedly forthcoming.

A second indication of a probable decline in total lands used for sheep stems from the persistent demands by other livestock. Sheep lands can often be utilized by other grazing animals. The relatively high cattle value and low sheep value since World War II encourage a diversion of more and more grazing land from sheep to cattle. It was not until 1953 that cattle herds in the 11 Western States exceeded sheep; today in these States, cattle, excluding those kept for milk, are 52 percent more numerous. Animal production and range-management scientists have found that the forage requirement of 1 cow is approximately 5 times that of 1 sheep. However, the estimated farm value per head of stock cattle has increased from 6.5 times that of stock sheep in 1947 and 1949 to more than 7 in 1960-63. Cattle prices were lower in 1964-65 and the ratio was down to 7.0, but the long-term outlook for sheep values versus cattle values remains unchanged.

A third, often cited factor supporting predictions of declining availability of land is the growing demand for land for nonlivestock uses. This pressure, however, may not represent the immediate major threat that many people suppose. A recent publication indicates that demands of a population of 225 million (expected by 1975) would probably call for use of only 11 percent of our total land for nonagricultural purposes (3). This compares with 10 percent in 1958.

The Western States have been relatively hard hit by the removal of land from grazing use. Washington, Oregon, and California had 18 percent of their total available grazing land diverted to other uses during the 10 years 1950-59. In the Mountain States about 39 million acres of pasture land, or 11 percent of the total, were diverted to nongrazing forest lands and special uses during this period (17). Such pressures are even more accentuated in certain local levels.

Producing Units

Changes in sheep population and in land availability were not the only adjustments the sheep producing industry faced after World War II. During the 1950's the industry also underwent significant changes in number, size, and location of producing units. Between 1950 and 1959, the number of farms and ranches reporting sheep on hand increased to 341,397, or 6.8 percent. Unfortunately, more recent data are not available. This figure is still 25 percent below the number of units reporting sheep on hand in 1945. This increase was attributed to several factors including: (1) the incentive payment for wool production provided under the National Wool Act of 1954, (2) elimination of surplus wool stocks that had a depressing effect on wool prices, (3) the culmination of industry "shake outs" following World War II, and (4) the increasing number of professional and business men who engage in avocational sheep raising (17).

Producing units of all sizes but the very smallest shared in the total increase to some extent. However, a relatively greater increase occurred in the number of those production units having 100-299 sheep than in other size categories (table 2). Several reasons that appear to have contributed to the increase in relative importance of units with over 25 sheep were: (1) economic pressures encourage certain sheep-dependent producers to produce more units when prices soften, (2) the inefficiencies of small units in both farm-flock and range operations, and (3) lesser dependence of smaller flock operators on sheep and their ability to shift out of sheep production when prices are poor.

The increase in the relative importance of larger units was accompanied by modest increase in average flock size, which for the country as a whole, was relatively minor (2 percent), but in certain areas, significant. There was a marked decline in Texas and a lesser decline in the 11 Western States. The remainder of the United States, where farm flocks predominate, increased average flock size by 22 percent during 1950-59 (table 3). It would thus seem that evaluations of scouring plant locations in the West and Texas might anticipate a lessening of the wool supply in their potential trade area over the years. Comparable information for the 1960's is not available, but the sharp drop in sheep numbers during this period probably has reduced flock sizes throughout the United States.

The Volume and Grades of Wool Produced in the 11 Western States and Texas

Some 150 million pounds of shorn grease wool are produced annually in the 11 Western States and Texas. The amounts of wool produced within certain counties, trade areas, or States may be adequate for studying transportation and baling problems, but to evaluate the feasibility of scouring in a particular area requires some knowledge of the qualities of wool produced. Differences in staple length largely determine whether the wool may be processed on the woolen or worsted system. Thus, the staple length of the wool produced within the trade area of a proposed plant is particularly important if the plant operators plan to purchase wool for scouring and resale or to depend heavily upon commission scouring for the wool growers. This is due to the preference of topmakers and worsted

Table 2.--Percentage of sheep producing units, by number of sheep held, United States, 1950 and 1959

Number of sheep held per unit	Percentage of units	
	1950	1959
	Percent	Percent
Less than 25	59.2	49.5
25 - 99	31.5	34.4
100 - 299	5.6	10.8
300 - 999	2.2	3.7
1,000 or more	1.5	1.6
All units	100.0	100.0

Source: Adapted from reports of Bureau of the Census.

Table 3.--Average number of sheep per farm or ranch and percentage of change, by specified area, United States, 1950 and 1959

Area	Average size of flock		Percentage of change from 1950 to 1959
	1950	1959	
	Number	Number	Percent
Western:			
Mountain States	410	376	-8
Pacific States	164	152	-7
Texas	298	225	-24
All other States	41	50	+22
All areas	93	95	+2

Source: Adapted from Bureau of the Census reports.

mills to blend and scour their own wools or at least have them blended and scoured to their specifications.

Conditions for sheep production in the West vary widely from the high rainfall areas of the Pacific Coast to semidesert areas in several States, particularly in the Southwest. In some areas the sheep are summered in high mountain range and wintered on irrigated valley farms, while in others they are run on the same range year-round. Sheep producers in the various areas run sheep of different breeds and crosses and, according to their preferences, select sheep having the characteristics to meet variations in climate, geography, and feed conditions.

To the extent that production conditions within an area are similar, most producers tend to run similar types of sheep. Based on this principle, the New Mexico Agricultural Experiment Station in cooperation with the Agricultural Experiment Stations of the Western States and the U.S. Department of Agriculture conducted a comprehensive study of sheep production areas and the predominant grades of wool produced in each (14). A delineation of the production areas along with the corresponding wool quality data is presented (fig. 1) so that one may adapt the information to meet the requirements of their individual analysis. The quality data are described in terms used by the wool trade and are based upon specifications suggested by the U.S. Department of Agriculture (table 4).

The sheep production characteristics and practices of each of the areas have been published previously (14) and are not presented in this report. However, the volume and quality of wool produced in major sheep production areas during the years 1955 and 1962-64 are summarized (fig. 1 and table 5). The 1955 production data are the earliest available and when compared to the 2 most recent marketing years for which comparable data are complete (1962 and 1964) provide some indication of trends. The production data were compiled from Department of Agriculture records of applications for wool incentive payments under the National Wool Act of 1954. The 1963 data represented only 9 months due to a change in application filings and was omitted from the analysis. The quality data are estimates of the predominant grade or grades within the production areas, and subsequent computations using these data, such as presented in table 5, are also estimates. It is suggested that in analyzing individual circumstances, State statisticians in the potential supply area should be contacted to obtain the latest available county wool production figures.

Wool quality and production vary widely in the 11 Western States and Texas, and data presented provide only a quick guide for evaluating the relative importance of various qualities of wools but emphasize the importance of location (table 5). For example there is nearly as much wool produced in and around San Angelo, Tex. (Texas area 2) as in the 5 Western States of Washington, Oregon, California, Arizona, and Nevada combined.

The Volume, Grades, and Origin of Wools Scoured in the 11 Western States and Texas

The amounts and grades of locally produced wool which is scoured by plants located in the 11 Western States and Texas vary widely among States, but

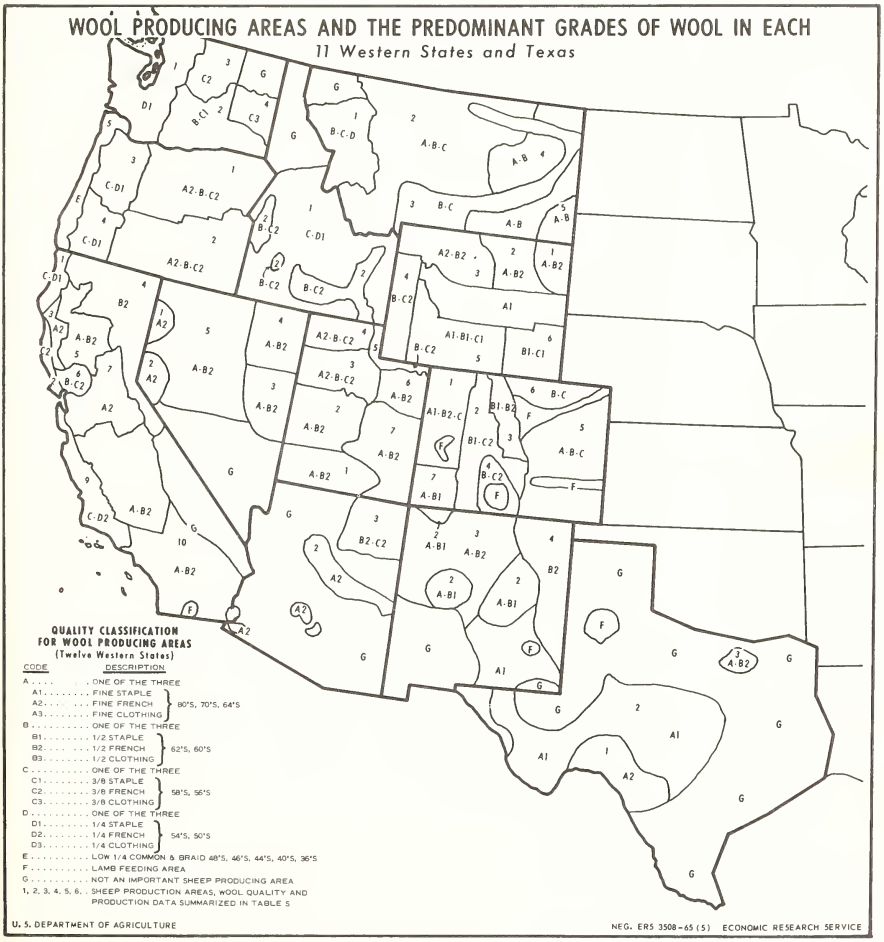
WOOL PRODUCING AREAS AND THE PREDOMINANT GRADES OF WOOL IN EACH
11 Western States and Texas
QUALITY CLASSIFICATION FOR WOOL PRODUCING AREAS
(Twelve Western States)
CODE DESCRIPTION
A . . . . . ONE OF THE THREE
A1 . . . . . FINE STAPLE
A2 . . . . . FINE FRENCH
A3 . . . . . FINE CLOTHING
80'S, 70'S, 64'S
B . . . . . ONE OF THE THREE
B1 . . . . . 1/2 STAPLE
B2 . . . . . 1/2 FRENCH
B3 . . . . . 1/2 CLOTHING
62'S, 60'S
C . . . . . ONE OF THE THREE
C1 . . . . . 3/8 STAPLE
C2 . . . . . 3/8 FRENCH
C3 . . . . . 3/8 CLOTHING
58'S, 56'S
D . . . . . ONE OF THE THREE
D1 . . . . . 1/4 STAPLE
D2 . . . . . 1/4 FRENCH
D3 . . . . . 1/4 CLOTHING
54'S, 50'S
E . . . . . LOW 1/4 COMMON & BRAID 48'S, 46'S, 44'S, 40'S, 36'S
F . . . . . LAMB FEEDING AREA
G . . . . . NOT AN IMPORTANT SHEEP PRODUCING AREA
1, 2, 3, 4, 5, 6. . SHEEP PRODUCTION AREAS, WOOL QUALITY AND PRODUCTION DATA SUMMARIZED IN TABLE 5
U. S. DEPARTMENT OF AGRICULTURE
NEG. ERS 3508-65 (5) ECONOMIC RESEARCH SERVICE

Figure 1

Table 4.--Staple length of domestic wool, by grades, United States 1/

Commercial length class 2/	Fine (64's and finer)	1/2 blood (60's and 62's)	3/8 blood (56's and 58's)	1/4 blood (50's and 54's)	Low 1/4 blood (46's and 48's)	Common and Braid (44's and coarser)
	Inches	Inches	Inches	Inches	Inches	Inches
Staple	2.75	3.00	3.25	3.50	4.00	5.00
Good French	2.25	2.50	2.50	2.50	--	--
Average French	1.25	1.50	--	--	--	--
Short French and clothing	Less than 1.25	Less than 1.50	Less than 2.50	Less than 2.50	Less than 4.00	Less than 5.00

1/ Adapted from von Bergen, W., Wool Handbook, (38).
2/ The length designations are based on unstretched staple length and represent a minimum length for the bulk of the staples in a sample, except for the shortest length class.

according to the plant operators, remain surprisingly constant from one year to another. Thus, the information presented here relating to more than 36 million pounds should provide an excellent indication of the grades and origins of wools already being scoured by existing plants, even though it does not include: (1) 180,000 pounds of Australian wool scoured at 1 plant, (2) a total of 640,000 pounds scoured by 3 small blanket plants in the area, or (3) data on 1 Colorado and 2 Texas plants which began full operations after the fieldwork for this study was complete, (25, 26).

The 5 scouring plant operators interviewed reported receiving wools from 9 of the 11 Western States, plus Texas, Nebraska, and Missouri (table 6). Texas was the most important single source, supplying nearly 18.4 million pounds of grease wool to Western scouring plants, more than a third of its total production. More than 6.5 million pounds, or 87 percent of the annual production of Oregon, was scoured in Western plants. Other States with a large proportion of their annual production scoured in existing Western plants were Washington, 55 percent; New Mexico, 51 percent; and Idaho, 20 percent. Less than 5 percent of the wools produced in California, Colorado, and Utah were scoured in the West and less than 1 percent of the Montana wools. Conspicuously absent from the list of States supplying wool to the 5 Western scouring plants studied was Wyoming, with an annual shorn grease wool production of some 20 million pounds. Neither were Nevada nor Arizona included.

Fine wool accounted for more than 60 percent of all wool scoured in the 5 plants; 1/2 Blood, 13 percent; 3/8 Blood, nearly 7 percent; 1/4 Blood, 9 percent; and Low 1/4 Blood, 2 percent. Various "off-wools" at 5 percent and pulled wools at 4 percent made up the remainder. Omitting the off-sorts and pulled wools,

Table 5.--Quantity, grade, and staple length of shorn grease wool produced in 11 Western States and Texas, by State and producing area, 1955 and 1962-64

State and producing area 1/	Grade and staple code 1/	Shorn grease wool production			
		1955		1962-64 2/	
		1,000 pounds	Percent	1,000 pounds	Percent
Arizona:					
1 and 2	A2	661	22.0	1,474	42.5
3	B2-C2	878	29.2	1,401	40.3
F	--	3	.1	1	3/
G	--	1,464	48.7	597	17.2
Total	--	3,006	100.0	3,473	100.0
California:					
1	C1-D1	378	2.0	515	3.2
2	C2	1,514	8.0	1,572	9.8
3 and 7	A2	3,161	16.7	1,937	12.1
4	B2	662	3.5	592	3.7
5, 8, and 10	A2-B2	9,691	51.2	8,392	52.4
6	B2-C2	3,085	16.3	2,044	12.7
9	C2-D2	227	1.2	313	1.9
F	--	114	.6	620	3.9
G	--	95	.5	42	.3
Total	--	18,927	100.0	16,027	100.0
Colorado:					
1	A1-B2-C	3,086	26.0	4,241	32.1
2	B1-C2	1,139	9.6	1,187	9.0
3	B1-B2	344	2.9	303	2.3
4	B2-C2	2,030	17.1	1,623	12.3
5	A-B-C	1,579	13.3	986	7.4
6	B-C	404	3.4	463	3.5
7	A1-B1	1,234	10.4	833	6.3
F	--	2,053	17.3	3,583	27.1
Total	--	11,869	100.0	13,219	100.0
Idaho:					
1	C1-D1	5,867	56.5	3,392	38.0
2	B2-C2	4,392	42.3	5,454	61.1
G	--	125	1.2	84	.9
Total	--	10,384	100.0	8,930	100.0
Montana:					
1	B-C-D	607	3.9	410	3.1
2	A-B-C	6,983	44.9	5,334	40.4
3	B-C	3,421	22.0	2,881	21.8
4 and 5	A-B	4,526	29.1	4,568	34.6
G	--	16	.1	7	.1
Total	--	15,553	100.0	13,200	100.0
Nevada:					
1 and 2	A2	951	23.3	528	23.5
3, 4, and 5	A2-B2	3,052	74.8	1,719	76.4
G	--	77	1.9	3	.1
Total	--	4,080	100.0	2,250	100.0

See footnotes at end of table.

Continued--

Table 5.--Quantity, grade, and staple length of shorn grease wool produced in 11 Western States and Texas, by State and producing area, 1955 and 1962-64--Continued

State and producing area 1/	Grade and staple code 1/	Shorn grease wool production			
		1955		1962-64 2/	
		1,000 pounds	Percent	1,000 pounds	Percent
New Mexico:					
1	A1	4,759	42.1	4,322	46.5
2	A1-B1	2,475	21.9	2,321	25.0
3	A2-B2	2,035	18.0	1,557	16.7
4	B2	543	4.8	228	2.4
F	--	735	6.5	124	1.3
G	--	757	6.7	750	8.1
Total	--	11,304	100.0	9,302	100.0
Oregon:					
1 and 2	A2-B-C2	3,832	57.0	2,183	38.3
3 and 4	C1-D1	2,239	33.3	2,736	48.0
5	E	652	9.7	781	13.7
Total	--	6,723	100.0	5,700	100.0
Texas:					
1	A2	9,740	20.6	10,424	25.3
2	A1	32,485	68.7	28,506	69.4
3	A2-B2	284	.6	203	.5
F	--	331	.7	115	.3
G	--	4,445	9.4	1,839	4.5
Total	--	47,285	100.0	41,087	100.0
Utah:					
1, 2, 6, and 7	A2-B2	6,910	54.8	5,461	54.4
3 and 4	A2-B-C2	5,208	41.3	3,870	38.6
5	B2-C2	492	3.9	699	7.0
Total	--	12,610	100.0	10,030	100.0
Washington:					
1	D1	90	3.2	232	11.1
2	B1-C1	1,888	67.4	1,236	59.4
3	C2	154	5.5	72	3.5
4	C3	636	22.7	512	24.6
G	--	34	1.2	30	1.4
Total	--	2,802	100.0	2,082	100.0
Wyoming:					
1 and 2	A2-B2	3,458	17.9	4,544	23.1
3	A2-B2	2,898	15.0	2,903	14.8
4	B2-C2	2,106	10.9	1,914	9.7
5	A1-B1-C1	4,173	21.6	3,881	19.8
6	B1-C1	1,507	7.8	1,353	6.9
7	A1	5,178	26.8	5,056	25.7
Total	--	19,320	100.0	19,651	100.0
All States	--	163,863	--	144,951	

1/ See fig. 1, p. 9.
2/ 2-year average. Not adjusted for late-filed applications and subsequent minor corrections. 1963 National Wool Act data represented only 9 months and were omitted.
3/ Less than 0.05 percent.

Table 6.--Grease wool scoured, by fineness and staple length and State of origin, at 5 wool scouring plants in the 11 Western States and Texas, 1959

Fineness and staple length 1/	State of origin											Total 2/	Proportion of volume scoured
	Tex.	Oreg.	N. Mex.	Idaho	Wash.	Calif.	Colo.	Nebr.	Utah	Mo.	Mont.		
	1,000 pounds												Percent
Fine Staple	1,868	3/ 367	857	70	166	96	--	160	40	--	--	3,624	10.0
Fine French	8,669	920	2,755	310	310	142	350	--	350	--	--	13,807	38.1
Fine Clothing	3,521	139	740	6	68	--	--	--	--	--	--	4,473	12.4
1/2 Blood Staple	1,000	347	220	913	308	--	--	30	--	--	--	2,818	7.8
1/2 Blood French	500	210	125	26	26	--	--	--	--	--	--	888	2.5
1/2 Blood Clothing	350	246	75	6	141	166	--	--	--	--	--	985	2.7
3/8 Blood Staple	275	339	65	148	105	--	68	68	--	--	--	1,067	2.9
3/8 Blood French	150	394	33	22	22	--	90	90	--	--	--	800	2.2
3/8 Blood Clothing	145	132	33	25	32	45	45	45	--	--	--	501	1.4
1/4 Blood Staple	--	1,787	--	607	138	--	--	--	--	--	--	2,533	7.0
1/4 Blood French	260	394	--	22	22	--	--	--	--	--	--	698	1.9
1/4 Blood Clothing	--	127	--	16	30	--	--	--	--	--	--	173	.5
Low 1/4 Staple	--	307	--	22	54	--	--	--	--	--	--	382	1.1
Low 1/4 Clothing	--	256	--	4	9	--	--	--	--	--	--	267	.7
Off-Wools 4/	1,326	160	164	68	40	36	50	--	--	--	13	1,857	5.1
Pulled Staple 5/	--	378	--	--	--	252	--	--	--	--	--	630	1.7
Pulled French 5/	--	68	--	--	--	45	--	--	--	--	--	113	.3
Pulled Clothing 5/	390	8	--	--	--	5	--	--	--	200	--	603	1.7
Total 2/	18,454	6,577	5,066	2,264	1,473	788	603	393	390	200	13	36,220	100.0
	Percent												
Proportion of volume scoured	50.9	18.2	14.0	6.2	4.1	2.2	1.7	1.1	1.1	0.5	6/	100.0	--

1/ Length classification based on Suggested Staple Lengths for Grades of Grease Wool (22). 2/ Computed from unrounded data. 3/ Does not include 180,000 pounds imported from Australia. 4/ Tags, crutchings, and clippings. 5/ Wool removed from the pelts of slaughtered lambs and sheep. 6/ Less than 0.05 percent.

wools of sufficient length to be classified as "Staple" amounted to 32 percent of the wools scoured; French Combing wools, 49 percent; and wools classified as clothing, 19 percent. One grade, Fine French Combing, accounted for nearly 40 percent of all the wool reported. Most of this wool came from 2 States, Texas and New Mexico. Texas, in fact, produced more than 50 percent of all the wool scoured at the 5 plants. While the data presented here are in more detail than that presented in the previous section relating to wool production and are not exactly comparable, the production and scouring information should provide an insight to the quantity and quality of the grease wool supply in the 11 Western States and Texas and to what is already being scoured at local plants.

III. FLOW PATTERNS OF GREASE AND SCOURED WOOLS FROM 14 WESTERN STATES TO MANUFACTURING POINTS

Practically all the wool produced in the West is transported to the East for manufacturing. Motor carriers, railroads, and water carriers all share in this movement, individually and in combination. A description of the methods by which wool produced in the 11 Western States, Texas, North Dakota, and South Dakota is transported from point of production to mill distribution is developed in this section. Scouring plants and baling facilities ideally should be located to intercept the maximum tonnage of wools. Successful interception of shipments may depend largely upon the type of carrier employed in the various origin-destination movements; particularly if the availability of transit privileges is the deciding factor.

Motor carriers in particular present a challenge. Five types of motor carriers are involved in wool transportation and the possibilities of intercepting the movements and the potential for motor carrier transit privileges vary with each. The 5 types of motor carriers are: ICC Regulated, ICC Exempt, Private (own), Private (other firm), and Grower.

The ICC Regulated carrier is defined here to include all for-hire common and contract motor carriers operating with ICC permits. Even these carriers may haul grease and scoured wool within the exempt clause of ICC regulations. These for-hire public carriers are generally the only ones with a sufficient operating area to advantageously offer transit privileges.

The ICC Exempt classification includes those for-hire truckers who cater exclusively to those commodities specified in Administrative Rulings 107 and 110 of the Interstate Commerce Act and as such are not subject to ICC economic regulations. Familiar examples of this type of carrier are most for-hire haulers of livestock, poultry, and wool. Transit privileges are of little use to most of these truckers because they are primarily local haulers and have too few trucks.

The classification "Private (own)" relates to trucks operated entirely by the wool warehouses and scouring plants from whom flow data were obtained. "Private (other firm)" is a classification to delineate those trucks which haul wool but are not for hire nor owned by the local wool warehouses and scouring plants. This somewhat confusing situation arises primarily from the practice of many textile companies and others who operate fleets of trucks to deliver

finished goods to the West and pick up exempt commodities for backhauls. Textile firms' trucks usually pick up only that wool belonging to their company.

The "Grower" classification relates to vehicles operated by the wool producer or grower. Growers often deliver their own wool to local warehouses, but the lots are generally small and afford little opportunity for intermediate baling or scouring.

The flow data are divided into 3 forms of wool movements: baled grease wool, bagged grease wool, and scoured wool (all of which is baled). The information was obtained from wool scouring plant operators, balers, warehouse operators, and transportation firms. It describes the flow of some 132,700,000 pounds of wool, the equivalent of 70 percent of the area's production.

Sources, Volumes, Destination, and Type of Carrier of Baled Grease Wool

The volume and flow pattern of baled grease wool and the types of carriers involved should provide a valuable guide to the industry, whether one considers baling as a supplement or alternative to wool scouring. Information is presented relating to the flow pattern of baled grease wool from the State in which it was produced to intermediate baling or concentration points, then to its final destination for processing. The data were obtained from the operators of 8 of the 9 wool warehouses and 2 wool concentration points in the 11 Western States and Texas having balers in 1960.

Inbound Movements.--Slightly more than 50 million pounds of grease wool were transported from farms, ranches, or local warehouses in the West to intermediate baling points in 1959 (table 7). These inbound shipments of bagged wool to baling points were intrastate or from bordering States. The movements were usually of less than 150 miles.

Motor carriers participated in approximately 88 percent of the inbound movements to wool baling points. In general trucks will move a larger proportion of a given commodity on the relatively short hauls than do either rail or water carriers, which, in addition, are not available in many farming and ranching areas. The inbound movements by trucks belonging to the grower almost equaled the total volume moved by rail carriers. ICC Exempt carriers handled 68 percent of total inbound truck movements. And private trucks belonging to firms other than the wool warehouses moved slightly more than 1 million pounds of grease wool to baling points (table 7).

ICC Regulated carriers moved less than 17 percent of the total inbound volume and warehouse operators indicated that practically all of the wool moved by this type of motor carrier could be classified as interstate. This means that, in general, regulated carriers were more competitive in the longer truck hauls.

It should be noted that the large majority of inbound movements to baling points occur in a west-to-east direction pattern. There is only a very small volume which moves in an out-of-line direction prior to baling. The exceptions were some 225,000 pounds of Utah, Idaho, and Arizona wools moving west to Oregon

Table 7.--Quantity of grease wool shipped to baling facilities in 7 Western States, by State of destination and origin and by type of carrier, 1959

State of destination and origin	Truck					Rail	Total
	ICC regulated	ICC exempt 1/	Grower owned	Private: owned 2/	Total		
	1,000 pounds						
To California from--							
California	24	24	120	24	192	2,215	2,407
Hawaii 3/	--	--	--	--	--	--	25
Oregon	--	--	--	--	--	25	25
Nevada	51	--	--	--	51	--	51
Arizona	--	--	--	--	--	26	26
Total to California	75	24	120	24	243	2,266	2,534
To Colorado from--							
Colorado	985	--	657	--	1,642	--	1,642
Utah	310	--	--	--	310	--	310
Idaho	--	--	--	--	--	465	465
Wyoming	232	--	--	--	232	232	464
New Mexico	93	--	--	--	93	--	93
Nebraska	62	--	--	--	62	--	62
South Dakota	62	--	--	--	62	--	62
Total to Colorado	1,744	--	657	--	2,401	697	3,098
To Montana from--							
Montana	2,196	270	--	270	2,736	864	3,600
Wyoming	169	--	--	--	169	506	675
Idaho	84	29	--	--	113	--	113
Washington	--	--	--	--	--	112	112
Total to Montana	2,449	299	--	270	3,018	1,482	4,500
To New Mexico from--							
New Mexico	120	2,200	1,096	192	3,608	792	4,400
Arizona	36	457	--	--	492	211	704
Colorado	--	48	--	--	48	48	96
Total to New Mexico	156	2,705	1,096	192	4,149	1,051	5,200
To Oregon from--							
Oregon	413	--	--	469	882	56	939
Alaska 3/	--	--	--	--	--	--	78
Idaho	156	--	--	--	156	--	156
Washington	219	--	--	78	297	16	313
California	31	--	--	--	31	50	78
Total to Oregon	820	--	--	547	1,367	119	1,564
To South Dakota from--							
South Dakota	320	342	2,363	--	3,025	--	3,025
North Dakota	--	35	315	--	350	--	350
Montana	2,078	497	--	--	2,575	--	2,575
Wyoming	480	590	480	--	1,550	--	1,550
Total to South Dakota	2,878	1,464	3,158	--	7,500	--	7,500
To Texas from--							
Texas 4/	--	25,643	--	--	25,643	--	25,643
New Mexico	--	626	--	--	626	--	626
Total to Texas	--	26,269	--	--	26,269	--	26,269
Grand total	8,122	30,761	5,031	1,033	44,947	5,615	50,665

1/ For-hire carriers hauling only exempt commodities. 2/ Private carriers hauling exempt commodities (usually backhauls). 3/ Water carrier movement. 4/ Baling facilities owned and operated by motor carriers.

and California; otherwise, all flow arrows emitting from the Western States point in an easterly direction (figs. 2, 3). The tendency for wool baling to become an intermediate step in the flow of wool from point of production to point of manufacture is apparent when one considers the strategic location of wool baling facilities from Texas to Montana through the heart of the heaviest wool producing region of the United States.

Outbound Movements.--Prior to the installation of balers and the development of the Texas system of baling bags, practically all outbound shipments from warehouses were by rail. Low density of bagged wool and an extended length of haul, sharply restricted motor carriers' movements. Rails had practically a captive market. But baling has increased the density of the wool package making it economically possible for motor carriers to compete for longer wool shipments. Operators with balers reported that rate differentials between trucks and rails in many areas are practically nonexistent and that preference of service has become the major factor in choosing a carrier.

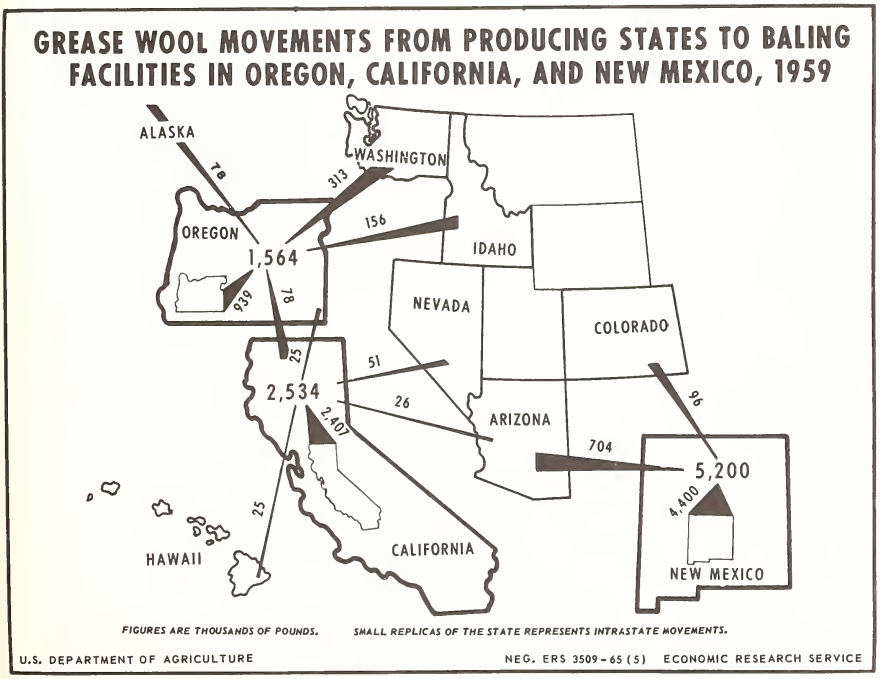

Figure 2

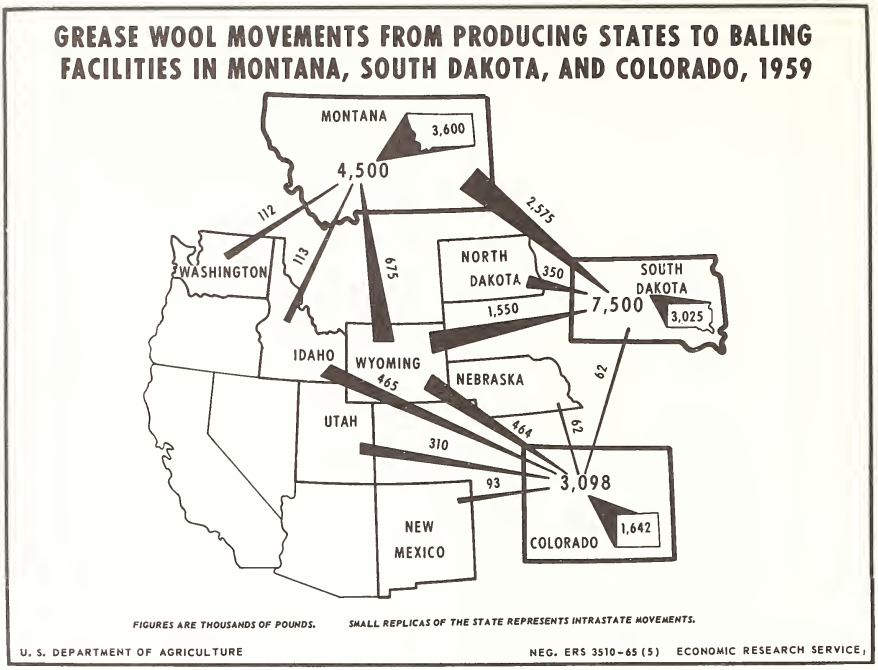

Figure 3

Motor carriers were the most commonly used means of transporting baled wool to the point of manufacture, accounting for 62 percent of the total, and in addition participated in combination movements with water carriers. This truck-water movement represented an additional 14 percent of the total baled wool movements. Less baled grease wool was moved by railroads than by the combination of water carriers and truck-water movements. Warehouse operators indicated that approximately 24 percent of the wool that moved east from their plants was transported by ICC Regulated trucks. No outbound movements by ICC Exempt carriers were reported (table 8).

The type of carrier transporting baled wool from the West varied somewhat with individual manufacturing areas. More than 20 million pounds of baled wool moved to the New England area, 53 percent of it by motor, 13 percent by rail, 33 percent by truck-water movement and 1 percent by water carrier. Approximately the same volume of baled wool was moved to the Southeast. Trucks accounted for 79 percent of the latter volume, rails, 21 percent, and water-carrier or truck-water movements, less than one-half of 1 percent. The Middle

Table 8.--Quantity of baled grease wool shipped from baling facilities in 7 Western States by State of origin and destination for manufacturing, by type of carrier, 1959

State of origin and destination	Truck			Rail	Water	Total
	ICC regulated	Private owned 1/	Total			
	1,000 pounds					
From California balers to--						
Massachusetts	266	--	266	1,419	89	1,774
Illinois	127	--	127	--	--	127
Pennsylvania	--	--	--	--	63	63
South Carolina	482	--	482	--	25	507
Oregon	--	63	63	--	--	63
Total from California	875	63	938	1,419	177	2,534
From Colorado balers to--						
Rhode Island	1,796	--	1,796	--	--	1,796
New York	--	--	--	465	--	465
South Carolina	--	134	134	702	--	836
Total from Colorado	1,796	134	1,930	1,167	--	3,097
From New Mexico balers to--						
Massachusetts	1,219	--	1,219	197	--	1,416
New England 2/	214	--	214	106	--	320
South Carolina	2,103	--	2,103	713	--	2,816
Georgia	--	192	192	--	--	192
Texas	456	--	456	--	--	456
Total from New Mexico	3,992	192	4,184	1,016	--	5,200
From Oregon balers to--						
Massachusetts	--	--	--	313	--	313
New England 2/	--	--	--	235	--	235
Southeast 2/	--	--	--	188	--	188
West Coast 2/	829	--	829	--	--	829
Total from Oregon	829	--	829	736	--	1,565
From South Dakota balers to--						
New England 2/	400	--	400	400	--	800
Rhode Island	525	--	525	--	--	525
Pennsylvania	350	--	350	--	--	350
Virginia	2,870	--	2,870	2,380	--	5,250
South Carolina	200	--	200	200	--	400
Georgia	175	--	175	--	--	175
Total from South Dakota	4,520	--	4,520	2,980	--	7,500
From Montana balers 3/	--	--	--	--	--	4,501
From Texas balers to--						
Maine	--	--	4/ 5	--	--	5
Massachusetts	--	--	4/3,685	--	5/3,636	7,321
Connecticut	--	--	4/ 231	--	5/142	373
New Hampshire	--	--	4/ 27	--	--	27
Rhode Island	--	--	4/2,362	--	5/2,799	5,161
New Jersey	--	--	4/437	--	--	437
New York	--	--	4/257	--	--	257
Pennsylvania	--	--	4/1,981	--	5/698	2,679
Tennessee	--	--	4/2,204	--	5/ 48	2,252
South Carolina	--	--	4/7,634	--	--	7,634
Georgia	--	--	4/ 26	--	--	26
Texas	--	--	4/ 8	--	--	8
California	--	--	4/88	--	--	88
Total from Texas	--	--	4/18,945	--	5/7,323	26,268
Grand total	12,012	389	31,346	7,318	7,500	50,665

1/ Private carriers hauling exempt commodities (usually backhaul). 2/ Specific States unknown. 3/ Destination and type of carrier data not available. 4/ Type of truck data not available. 5/ Truck-water movement.

Atlantic area received more than 4 million pounds of baled grease wool from the Western Region; 72 percent by truck, 16 percent by truck-water, 11 percent by rail, and 1 percent by water carrier (table 8). In evaluating a location for the operation of a wool-scouring establishment one should be extremely cognizant of water and truck-water movements of baled grease wool. Such movements from the producing area and baling points to the ports are usually quite short and the possibility of locating an "intermediate" scouring plant to intercept these wools is correspondingly restricted.

Sources, Volumes, Destination, and Type of Carrier of Bagged Grease Wool

The data presented thus far indicate that motor carriers are significant competitors of railroads for baled wool movements. But what about the movements of bagged, nonbaled grease wool--the traditional near-monopoly of the railroads? One hundred and nine known wool warehouse operators throughout the United States who might have handled wool produced in the West but who did not have access to baling facilities were mailed questionnaires requesting information on the sources, volumes, and destination of the wools they handled and the types of carriers involved. Out of 68 who responded, 49 reported data suitable for analysis. Thirty-two of the 68 responding were located in the 14 State areas under consideration and 6 additional warehouses reported handling some wool produced in the 14-State area. Only that information which pertains to wools produced in the 11 Western States, Texas, North Dakota, and South Dakota is presented.

Inbound Movements.--Bagged wool movements to the various warehouses were classified as either intra-area shipments or inter-area shipments. The first, and most important type includes shipments that originate and terminate within the 14 States under consideration. The second type, inter-area, includes those shipments which originated in the 14-State area but were marketed outside the area. Because there are significant differences in the types of transportation employed, data relating to intra-area shipments and inter-area shipments are presented separately.

Nearly 44 million pounds of bagged grease wool were received by the 32 Western warehouses without baling facilities which responded to the questionnaire. Motor carriers moved nearly 86 percent of these inbound shipments and rails, less than 14 percent. The proportions of wool brought to the warehouses by the various types of motor carriers were: ICC Regulated, 14 percent; ICC Exempt, 16 percent; trucks owned by the responding warehouses, 5 percent; private truck owned by other firms (except growers), 8 percent; and farm vehicles belonging to the growers, 42 percent. California warehouses accounted for nearly 85 percent of all inbound rail movements. Warehouses in such important wool producing States as Wyoming, South Dakota, Colorado, and New Mexico reported no inbound rail movements. The wool growers themselves appear to be the most important carrier of bagged wool to the local warehouses within the 14 Western States (table 9).

Inter-area movements present an entirely different picture. The importance of motor carriers and railroads is completely reversed with rail shipments amounting to 88 percent of the inbound volume of bagged wool. Nearly 40

Table 9.--Quantity of grease wool shipped to 32 Western wool warehouses without baling facilities, by State of destination and origin and by type of carrier, 1959

State of destination and origin	Truck						Rail	Total
	ICC regulated	ICC exempt 1/	Warehouse owned	Grower owned	Private owned 2/	Total		
	1,000 pounds							
To California from--								
California	2,194	2,025	1,833	198	--	6,250	2,400	8,650
Oregon	--	--	--	--	--	--	1,600	1,600
Nevada	--	--	13	--	--	13	1,237	1,250
Total to California	2,194	2,025	1,846	198	--	6,263	5,237	11,500
To Wyoming from Wyoming	--	--	2,265	--	791	3,056	--	3,056
To New Mexico from New Mexico	--	--	2,850	--	1,200	4,050	--	4,050
To South Dakota from--								
South Dakota	--	--	427	350	56	833	--	833
Wyoming	--	--	326	--	10	336	--	336
Montana	--	--	327	--	7	334	--	334
Total to South Dakota	--	--	1,080	350	73	1,503	--	1,503
To Colorado from--								
Colorado	--	300	1,200	--	--	1,500	--	1,500
Utah	--	875	375	--	--	1,250	--	1,250
Wyoming	--	300	200	--	--	500	--	500
Total to Colorado	--	1,475	1,775	--	--	3,250	--	3,250
To Oregon from--								
Oregon	139	--	--	--	--	139	46	185
Washington	210	--	--	--	--	210	--	210
Idaho	86	259	--	--	--	345	--	345
Total to Oregon	435	259	--	--	--	694	46	740
To Utah from Utah	718	--	718	--	--	1,436	718	2,154
To Washington from Washington	13	--	19	--	--	32	--	32
To Texas from Texas	2,927	3,088	8,041	1,784	1,527	17,367	235	17,602
Total intra-area shipments	6,287	6,847	18,594	2,332	3,591	37,651	6,236	43,887

See footnotes at end of table.

--Continued

Table 9.--Quantity of grease wool shipped to 32 Western wool warehouses without baling facilities, by State of destination and origin and by type of carrier, 1959--Continued

State of destination and origin	Truck						Rail	Total
	ICC regulated	ICC exempt 1/	Warehouse owned	Grower owned	Private owned 2/	Total		
	1,000 pounds							
To Iowa from South Dakota	200	--	--	--	--	200	--	200
To Minnesota from South Dakota	--	--	1,266	42	--	1,308	6,363	7,671
To Missouri from Texas	--	--	--	--	--	--	140	140
To Minnesota from North Dakota	--	--	--	42	--	42	670	712
To Massachusetts from--								
Idaho	--	--	--	--	--	--	858	858
Montana	--	--	--	--	--	--	2,202	2,202
Nevada	--	--	--	--	--	--	1,819	1,819
New Mexico	--	--	--	--	--	--	258	258
Total to Massachusetts	--	--	--	--	--	--	5,137	5,137
Total interarea shipments 3/	200	--	1,266	84	--	1,550	12,310	13,860
Grand total	6,487	6,847	2,416	19,860	3,591	39,201	18,546	57,747

1/ For hire carriers hauling only exempt commodities.
2/ Private trucks hauling exempt commodities (primarily backhauls).
3/ Wool produced in the West but handled by warehouses outside the area.

percent of these shipments involved wool produced in Idaho, Montana, Nevada, and New Mexico and shipped by rail to Massachusetts (table 9). Motor carrier movements were primarily by growers in Eastern South Dakota who marketed their wool in Minnesota.

Hence, it may be concluded that for the shorter, intra-area movements of bagged wool, trucks--particularly those owned by growers--are the most important method of movement. But the movements from one State to another and particularly the interregional movements, are generally by rail carriers.

Outbound Movements.--Outbound movements of bagged grease wool from the 32 responding warehouses located in the 14 Western States totaled 31,202,000 pounds, some 10 million pounds less than reported inbound shipments. This is partially due to changes in inventory but the primary causes are that some warehouse operators either did not know or did not choose to disclose the general area of their outbound shipments. In the data reported by Texas and New Mexico warehouse operators, inbound shipments exceeded outbound shipments by 14 million pounds and ICC Exempt motor carriers handled much of the outbound volume. Most of the larger textile firms, which predominate in purchasing Western wools, have mills scattered throughout the Eastern and Southern States. The fact that buyers arrange for a large proportion of outbound movements contributes to the warehouse operators' lack of knowledge relating to destinations.

Rail carriers transported about two-thirds of all the reported bagged wool movements, and trucks, the remainder. A complete description of the types of motor carriers is not available due to incomplete responses, but ICC Regulated carriers did account for nearly 70 percent of the outbound motor shipments (table 10).

Of the total of 25,134,000 pounds whose destination was reported, New England received 66 percent; the Middle Atlantic States, 11 percent; the Southeast, 20 percent; and the Midwest, 3 percent. Rail carriers handled slightly over 82 percent of the shipments to New England and the Middle Atlantic States, 80 percent of those to the Southeast, and 99 percent of the bagged wool shipments to the Midwest. The destination was not given for slightly over 6 million pounds of wool shipped from Texas warehouses and contrary to the general trend, motor carriers hauled all but 100,000 pounds of this tonnage (table 10).

Sources, Volumes, Destination, and Type of Carrier of Scoured Wool

The 5 wool scouring plants in the West on which data were obtained reported scouring 36,220,000 pounds of grease wool. From this, 15,100,000 pounds of scoured wool were obtained indicating an average shrinkage of about 58 percent. Inbound volumes are reported here in terms of grease pounds while outbound volumes are reported on a scoured or clean-wool basis.

Inbound Movements.--Motor carriers handled more than 98 percent of all inbound movements of grease wool to Western scouring plants. Rail and water carriers combined accounted for less than 2 percent of the total volume reported. Within the truck movements, ICC Regulated carriers were responsible for 33 percent of the total while ICC Exempt haulers accounted for 25 percent.

Table 10.--Quantity of grease wool shipped from 32 Western wool warehouses without baling facilities by State of origin and destination and by type of carrier, 1959

State of destination and origin	Truck		Rail	Total
	ICC regulated	Total 1/		
	1,000 pounds			
From California to--				
Massachusetts	--	--	5,620	5,620
New England	--	--	1,870	1,870
Middle Atlantic	--	--	1,870	1,870
Southeast	--	--	1,870	1,870
Total from California	--	--	11,230	11,230
From Colorado to--				
Massachusetts	--	--	2,682	2,682
South Carolina	--	--	750	750
Total from Colorado	--	--	3,432	3,432
From Oregon to--				
Massachusetts	--	--	1,164	1,164
New England	150	150	--	150
Middle Atlantic	145	145	--	145
Southeast	325	325	--	325
Total from Oregon	620	620	1,164	1,784
From South Dakota to--				
Minnesota	5	5	735	740
Massachusetts	5	5	245	250
South Carolina	5	5	245	250
Virginia	5	5	245	250
Total from South Dakota	20	20	1,470	1,490
From Texas to--				
Massachusetts	1,170	1,170	--	1,170
Rhode Island	333	333	--	333
2/	3,055	5,968	100	6,068
Total	4,558	7,471	100	7,571
From Utah to--				
Massachusetts	359	718	359	1,077
Southeast	359	718	359	1,077
Total from Utah	718	1,436	718	2,154
From Wyoming to--				
Massachusetts	844	844	1,767	2,611
Rhode Island	--	--	465	465
South Carolina	--	--	465	465
Total from Wyoming	844	844	2,697	3,541
Grand total	6,760	10,391	20,811	31,202

1/ Includes all motor carriers except public carriers for hire.
2/ Destination unknown.

Private trucks (not for hire) operated by firms other than the scouring plant brought in slightly more than 27 percent. Wool growers moved 14 percent and scouring plant operators handled 43,000 pounds, or about 1 percent. Wools produced in just 3 States--Idaho, Montana, and Washington--accounted for all the inbound rail movements (table 11).

Texas produced more than 50 percent of all the wool scoured in the 5 plants; and operators of plants located in Texas received some wool from as far away as Missouri and Nebraska. New Mexico, Colorado, Utah, and California supplied the remainder of the 25,150,000 pounds of wool scoured in Texas (fig. 4).

The Oregon plants scoured 11,070,000 pounds of grease wool, more than half of which was produced within the State. Three adjacent States--Washington, Idaho, and California--contributed nearly the entire remainder (fig. 5).

The 5 plants scoured less than 21 percent of the wool produced in the 14 States. Conspicuously absent from the list of Western States which supplied grease wool for scouring at Western plants are Wyoming, South Dakota, North Dakota, and for all practical purposes, Montana. On the other hand, about 87 percent of Oregon's grease wool production was scoured locally and about 50 percent of the New Mexico and Washington clip (table 12).

Table 11.--Quantity of grease wool delivered to 5 scouring plants in the 11 Western States and Texas, by State of origin and type of carrier, 1959

State of origin	Truck					Rail	Total
	ICC regulated	ICC exempt 1/	Grower owned	Private owned 2/	Total		
	1,000 pounds	1,000 pounds	1,000 pounds	1,000 pounds	1,000 pounds	1,000 pounds	1,000 pounds
California	24	693	--	31	748	--	3/ 788
Colorado	--	--	--	603	603	--	603
Idaho	1,965	--	--	--	1,965	299	2,264
Missouri	--	--	--	200	200	--	200
Montana	6	--	--	--	6	7	13
Nebraska	--	--	--	393	393	--	393
New Mexico	3,292	--	--	1,774	5,066	--	5,066
Oregon	3,307	430	2,338	4/ 502	6,577	--	6,577
Texas	2,083	7,814	2,500	6,056	18,453	--	18,453
Utah	117	--	--	273	390	--	390
Washington	1,003	--	267	134	1,404	69	1,473
Total	11,797	8,937	5,105	9,966	35,805	375	36,220

1/ For-hire carriers hauling only exempt commodities.
2/ Private carriers hauling exempt commodities (usually backhaul).
3/ Includes 40,000 pounds of water carrier movements.
4/ Includes 43,000 pounds hauled in trucks operated by the scouring plant.

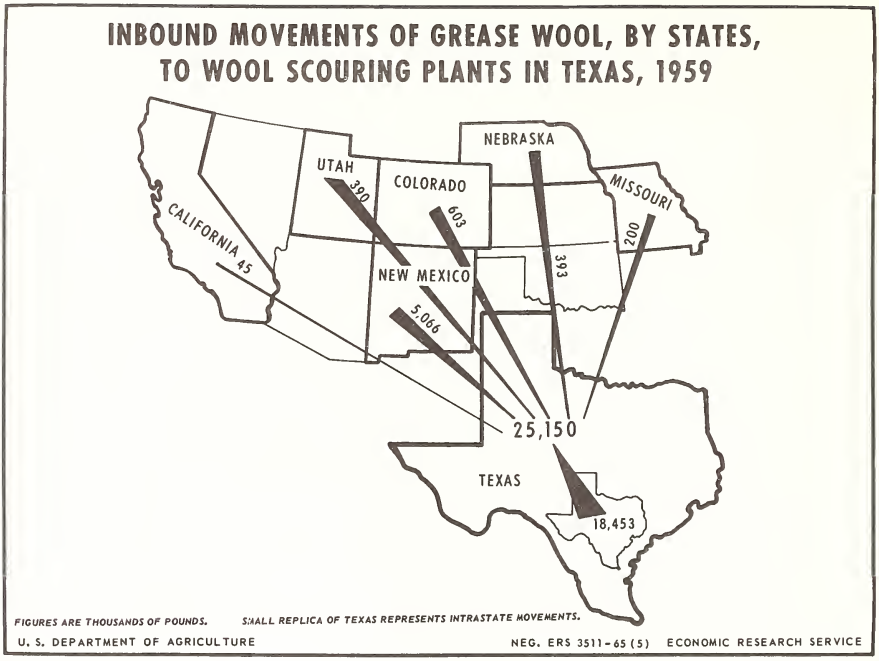

Figure 4

Outbound Movements.--The data indicates that approximately 22 percent of the 15,100,000 pounds of clean wool shipped from Western scouring plants was consumed by manufacturing plants within the area, primarily in Oregon and Washington. The Midwest received 22 percent; the New England and Middle Atlantic States combined, 29 percent; and the Southeast, 27 percent (table 13).

The importance of motor carriers to the Western scouring industry is evidenced by their hauling 94 percent of the outbound volume. ICC Exempt trucks alone hauled 55 percent of the total volume scoured (table 13). The small volume of scoured wool moved by railroads indicates that the scouring-in-transit privilege is little used in movements through Western plants.

Railroads moved less than 1 million pounds of scoured wool out of the West, and, strangely enough, did not move any of it into New England or the Middle Atlantic States, the most distant movements. The motor carriers accounted for all movements to these areas and an approximately equal volume to the Northeast, Midwest, and Southeast.

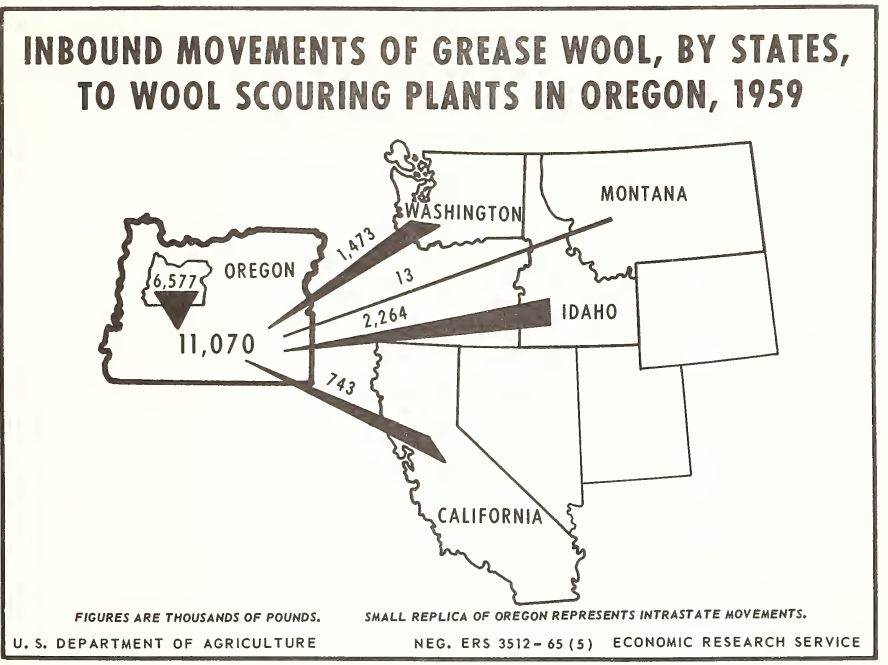

Figure 5

Total Flow Pattern

The flow pattern describing the movement of more than 70 percent of the wool produced in the 11 Western States, Texas, and North and South Dakota has already been provided. Each form of shipment--bagged, baled, and scoured--and the type of transportation used has been discussed. This section summarizes the individual flow patterns by destinations and presents a total flow pattern for wools produced in the 14-State area from point of production to mill consumption. Information is presented concerning the form of shipment, destination, and type of carrier for the equivalent of more than 105 million pounds of grease wool delivered to manufacturers and dealers outside the 14-State area (table 14). All intra-area shipments are deleted to avoid possible duplication. Scoured-wool weights have been converted to grease-wool equivalents so that the importance of the scouring industry is placed in its proper perspective.

New England was still the most important "market" of Western wools in 1959 but the importance of the Southeast was already quite evident. The Southeast

Table 12.--Grease wool production in 14 Western States and proportion scoured by 5 local plants, by State, 1959

Producing State	Grease wool production 1/	Scoured in 5 Western plants 2/	
		Quantity	Percentage of production
	1,000 pounds	1,000 pounds	Percent
Arizona	3,067	--	--
California	19,014	788	4.1
Colorado	13,589	603	4.4
Idaho	10,727	2,264	21.1
Montana	16,621	13	0.8
Nevada	3,024	--	--
New Mexico	10,621	5,066	47.7
North Dakota	6,072	--	--
Oregon	7,542	6,577	87.2
South Dakota	14,497	--	--
Texas	48,231	18,453	38.3
Utah	12,045	390	3.2
Washington	2,793	1,473	52.7
Wyoming	21,386	--	--
Total	172,608	3/ 35,627	20.6

1/ Obtained from: Wool Statistics and Related Data (33).
2/ All plants were located in Oregon and Texas
3/ Excludes 200,000 pounds from Missouri and 393,000 pounds from Nebraska

received 32 percent of the volume shipped, far outdistancing the Midwest with 16 percent and the Middle Atlantic States with 12 percent (table 14).

New England received the equivalent of some 42 million pounds of grease wool (table 14), of which about 80 percent was equally distributed between bagged wool and baled grease wool. The remainder was scoured wool (baled). Rail and motor carriers about divided 84 percent of that destined for New England. Truck trailers, transported over most of their route by water carriers, moved nearly all the remainder. All truck-water movements were baled prior to shipments. Motor carriers moved all the scoured wool to New England and in conjunction with water carriers handled 85 percent of all baled wool shipments. On the other hand, railroads hauled 83 percent of the bagged wool tonnage.

The Southeast received the equivalent of nearly 34 million pounds of grease wool shipped from the 14 Western States (table 14). In contrast to New England, only 12 percent of this was bagged wool, 60 percent, baled, and 28 percent, scoured. Motor carriers handled 75 percent of the shipments to the Southeast, including more than one-fourth of the bagged wool tonnage. Water carriers alone and in conjunction with motor carriers handled only 73,000 pounds of wool, about 2 percent of the total volume.

Table 13.--Quantity and destination by region of scoured wool shipped from 5 plants in the 11 Western States and Texas, by type of carrier, 1959

Region	Truck					Rail	Total
	ICC regulated	ICC exempt	Private 1/: owned 2/	Plant 3/: owned	Total		
	1,000 pounds	1,000 pounds	1,000 pounds	1,000 pounds	1,000 pounds	1,000 pounds	1,000 pounds
West:							
Oregon	179	--	--	--	179	179	358
Washington	2,202	--	--	--	2,202	--	2,202
Texas	--	88	67	--	155	--	155
Total	4/ 2,975	88	67	5/ 66	3,196	179	3,375
Midwest	1,377	1,484	259	--	3,120	153	3,273
New England	--	3,193	--	--	3,193	--	3,193
Middle Atlantic	--	1,258	--	--	1,258	--	1,258
Southeast	944	2,237	210	--	3,391	610	4,001
Total	2,321	8,172	469	--	10,962	763	11,725
Grand total	5,296	8,260	536	66	14,158	942	15,100

1/ For-hire carriers hauling only exempt commodities.
2/ Private trucks (except those owned by scouring plants) hauling exempt commodities (usually backhauls).
3/ Private trucks owned by scouring plants.
4/ Includes 594,000 pounds destined for either Washington or Oregon.
5/ Includes 66,000 pounds destined for either Washington or Oregon.

The Middle Atlantic States received only 12 percent of the outbound volume reported by Western wool handlers and scourers. More than half of the 12 million pounds was baled grease wool; 24 percent was scoured; and 23 percent, grease wool in bags. Here again, motor carriers were predominant, handling over 70 percent of the volume and in combination with water carriers handled an additional 6 percent. The volume (2.8 million pounds) moved by rail consisted almost entirely of bagged wool (table 14).

The Midwest received the equivalent of 17.4 million pounds of grease wool from the West with rail and motor carriers participating about equally in the shipments. Over half of this volume was received in bags with rails handling over 80 percent of the traffic. Baled wool shipments to the Midwest were practically nonexistent. Scoured wool accounted for the equivalent of 45 percent of the total volume and motor carriers moved more than 95 percent of it. No water or truck-water movements were reported (table 14).

It is doubtful that the Midwest was the final destination of much of the 9.5 million pounds of bagged grease wool. There are a few relatively large wool

Table 14.--Quantity of grease and scoured wool shipped from 53 wool handling facilities in the 14 Western States by destination and form of shipment and by type of carrier, 1959 1/

Destination and form of shipment	Rail		Truck		Water		Truck and water		Total	
	1,000 pounds	Percent	1,000 pounds	Percent	1,000 pounds	Percent	1,000 pounds	Percent	1,000 pounds	Percent
New England:										
Baled	2,670	16	8,409	44	89	100	6,577	100	17,745	42
Scoured 2/	--	--	7,660	41	--	--	--	--	7,660	18
Bagged	13,707	84	2,887	15	--	--	--	--	16,594	40
Total	16,377	45	18,956	27	89	50	6,577	90	41,999	40
Middle Atlantic:										
Baled	465	17	5,346	61	63	100	698	100	6,572	53
Scoured 2/	--	--	3,016	34	--	--	--	--	3,016	24
Bagged	2,335	83	478	5	--	--	--	--	2,813	23
Total	2,800	8	8,840	12	63	36	698	9	12,401	12
Southeast:										
Baled	4,183	49	16,020	64	25	100	48	100	20,276	60
Scoured 2/	1,463	17	8,134	32	--	--	--	--	9,597	28
Bagged	2,934	34	1,053	4	--	--	--	--	3,987	12
Total	8,580	23	25,207	35	25	14	48	1	33,860	32
Midwest:										
Baled	--	--	127	1	--	--	--	--	127	1
Scoured 2/	367	4	7,484	82	--	--	--	--	7,851	45
Bagged	7,908	96	1,555	17	--	--	--	--	9,463	54
Total	8,275	23	9,166	13	--	--	--	--	17,441	16

1/ Data obtained from 5 scouring plants; 10 wool baling plants; and 38 wool warehouses, 6 of which were not located in the 14 Western States but had wool which had been produced in the West. Western intra-area shipments deleted to avoid duplication.

2/ Grease wool equivalent weights with an average yield of 41.68 percent.

warehouses in the Midwest which solicit wools from the West. Wools are often assembled at these warehouses, then graded, baled, and reshipped to ultimate mill points.

Approximately 57 million pounds of grease wool produced in the 14 Western States in 1959 are not accounted for in the above data. It is known, however, that nearly all of this unaccounted-for volume moved out of the area in bags. The 3 scouring plants not included in the analysis had a total volume of less than one-half million pounds of grease wool and all but 1 of the Western warehouses and concentration points with baling facilities cooperated fully. Thus if, as believed, the available data relating to the shipments of bagged wool from the West are representative, the analysis of carriers and destinations is applicable to most of the 57 million pounds not accounted for.

IV. CHANGES IN THE LOCATION AND CHARACTERISTICS OF THE WOOL PROCESSING INDUSTRY

The distance between the area of wool production and the wool mills has a direct influence on transportation and other wool marketing costs. Shorn-wool production is concentrated in the West and this situation is not likely to change in the near future. On the other hand, the wool processing industry is concentrated along the eastern seaboard, primarily in New England. But significant changes in location of the processing industry appear to be underway which may greatly influence the feasibility of baling and scouring in the producing areas.

Scouring is but one step of the wool manufacturing process. Establishments, other than wool scouring plants, primarily engaged in processing wool products include combing plants, yarn mills, manufacturers of woolen and worsted fabrics, finishing plants, and manufacturers of wool carpets and rugs. The total number of establishments primarily engaged in some aspect of woolen and worsted manufacture decreased from 923 in 1947 to 768 in 1958, and there has been a big change in their location (table 15). In 1947, New England accounted for over half of these establishments and the South less than 7 percent. By 1958, the number of woolen and worsted establishments in New England had declined more than 25 percent while the number of those in the South nearly doubled. Trade reports indicate that the increase in woolen and worsted production in the South is continuing. The distribution of manufacturing establishments in other areas of the United States remained about the same during 1947-58 except for some expansion in the West, primarily in California.

The basic reasons reported for the shift of the textile industries away from New England are lower labor costs and lower taxes. With few exceptions, the postwar plants built in the South were branch plants of established northern firms and not new enterprises opened up with Southern capital or management (18).

Contrary to the general downward trend in total number of woolen and worsted establishments, the number of scouring and combing plants has increased. Important functions performed by these plants include scouring, carbonizing, and blending of wool and producing tops. Scouring and combing establishments in the United States increased from 54 in 1947, to 74 in 1954, and to 81 in 1958. During

Table 15.--Number of establishments by industry engaged primarily in woolen and worsted manufacture, by region and State, United States, 1947, 1954, and 1958

Region and State	Scouring and combing			Spinning, winding and twisting 1/			Weaving, dyeing, and finishing 2/			Total		
	1947 3/	1954	1958	1947	1954	1958 4/	1947	1954	1958 5/	1947	1954	1958
	Number	Number	Number	Number	Number	Number	Number	Number	Number	Number	Number	Number
New England:												
Massachusetts	40	35	29	57	43	40	93	69	75	190	147	144
Rhode Island	12	12	13	43	38	24	78	49	52	133	99	89
Other States 6/	3	2	6	35	35	25	115	87	75	153	124	106
Total	55	49	48	135	116	89	286	205	202	476	370	339
Middle Atlantic:												
New Jersey	3	4	4	12	13	9	21	15	16	36	32	29
New York	2	1	1	40	31	14	61	33	78	103	65	93
Pennsylvania	9	9	12	69	53	39	82	49	53	160	111	104
Total	14	14	17	121	97	62	164	97	147	299	208	226
North Central:												
Wisconsin	1	2	3	6	4	3	11	8	6	18	14	12
Other States 7/	1	1	--	11	11	8	31	25	23	43	37	31
Total	2	3	3	17	15	11	42	33	29	61	51	43
Southern:												
Georgia	--	--	--	1	3	7	5	8	11	6	11	18
North Carolina	--	1	5	6	12	16	9	10	9	15	23	30
South Carolina	--	3	4	4	6	14	4	8	12	8	17	30
Other States 8/	--	--	--	8	12	8	24	20	33	32	32	41
Total	--	4	9	19	33	45	42	46	65	61	83	119
Western:												
California	1	1	--	1	5	10	6	7	11	8	13	21
Other States 9/	2	3	4	2	3	2	14	11	14	18	17	20
Total	3	4	4	3	8	12	20	18	25	26	30	41
United States	74	74	81	295	269	219	554	399	468	923	742	768
	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent
New England	74.3	66.2	59.3	45.8	43.1	40.6	51.6	51.4	43.2	51.6	49.9	44.2
Middle Atlantic	18.9	18.9	21.0	41.0	36.1	28.3	29.6	24.3	31.4	32.4	28.0	29.4
North Central	2.7	4.1	3.7	5.8	5.5	5.0	7.6	8.3	6.2	6.6	6.9	5.6
Southern	--	5.4	11.1	6.4	12.3	20.6	7.6	11.5	13.9	6.6	11.2	15.5
Western	4.1	5.4	4.9	1.0	3.0	5.5	3.6	4.5	5.3	2.8	4.0	5.3
United States	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

1/ Includes establishments spinning wool carpet yarns and manufacturing wool carpets and rugs.
2/ Excludes establishments spinning wool carpet yarns and manufacturing wool carpets and rugs.
3/ Includes 20 topmakers with no manufacturing facilities.
4/ Excludes 13 manufacturers of tufted wool carpets and rugs.
5/ Includes 85 shrinking and sponging mills.
6/ Includes Connecticut, Maine, New Hampshire, and Vermont.
7/ Includes Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, and Ohio.
8/ Includes Alabama, Arkansas, Delaware, Kentucky, Florida, Maryland, Mississippi, Oklahoma, Tennessee, Virginia, and West Virginia.
9/ Includes Colorado, New Mexico, Oregon, Texas, Utah, and Washington.
Source: Adapted from Bureau of the Census reports.

the 12 years 1947-58, the proportion of these establishments in New England decreased from 75 percent to 59 percent. On the other hand, the South, which had no scouring and combing operations in 1947, had 11 percent of the total in 1958 all of which were in North and South Carolina (table 15).

Wool yarn mills are primarily spinning mills but Census also includes in this industry those plants engaged in winding or spooling yarn that is spun elsewhere and those that sell yarn spun by others on contract or commission. Thus, the number of actual wool yarn mills is not available, nor is correct information on the extent to which they maintain their own scouring facilities. The number of these spinning, winding, and twisting establishments decreased nearly 25 percent during 1947-58. The number in New England decreased one-third; and in the Middle Atlantic States, about one-half. But in the South the number nearly tripled, accounting for more than 20 percent of all these establishments in 1958. Nearly 70 percent of the spinning, winding, and twisting industry remained in New England and the Middle Atlantic States in 1958. But according to trade reports, there is a continuing trend for this industry to move south and west.

The weaving, dyeing, and finishing mills compose the last general segment of the woolen and worsted manufacturing industry. Manufacturers of woolen and worsted fabrics primarily weave fabrics more than 12 inches wide. Finishers of wool textiles primarily dye and finish woven woolen or worsted fabrics, or dye wool, tops, or yarns. Most wool yarns and fabrics are dyed or otherwise finished in the spinning or weaving plants in which they are manufactured. Also included as finishing establishments in the Census definition are: plants primarily engaged in bleaching, printing,or otherwise finishing fabrics, yarn, thread, tops, or raw stocks of textiles; plants primarily engaged in flocking or sueding fabrics; and plants printing or embossing on plastics.

Trends toward relocation of the weaving, dyeing, and finishing industry are difficult to evaluate because the 1958 data are not comparable with those for previous years. But the 1947-54 data indicate that the South is gaining somewhat in importance. The tendency to relocate does not seem to be as great in this industry, however, as in the scouring and combing industry, or as in the spinning, winding, and twisting industry.

Differences in the size of establishments in the various regions can only be estimated. But some idea may be obtained by comparing number of spindles, combs, and looms in a region with the number of woolen and worsted establishments in the appropriate industry. The Census classification of more than one type of establishment within an industry and the fact that any given establishment usually performs more than one process in the manufacture of woolens and worsteds preclude an accurate comparison.

Just prior to World War II, there were over 2,500 wool combs operating in the United States. More than 96 percent of them were located in New England and the Middle Atlantic States. In 1949, the number of combs had increased to 2,700 and 95 percent were located in New England and the Middle Atlantic States. A significant change began to take place both in the number and location of wool combs between 1949 and 1957. The number of combs dropped to about 1,500, a decrease of some 45 percent in 8 years. And the proportion of combs in the South increased from less than 3 percent in 1949 to 22 percent in 1957. The

number of combs appears to have leveled off at about the 1957 level (1,500), but the trend to locate in the South has continued (table 16).

From the latest information available, it appears that the Southern scouring and combing establishments tend to be much larger than their Northern counterparts. New England had about 60 percent of the establishments and 57 percent of the combs; the Middle Atlantic States, 21 percent of the establishments, and only 11 percent of the combs; and the Southern States, 11 percent of the establishments, but 29 percent of the combs.

The number of woolen and worsted spinning spindles in the United States has decreased greatly since World War II, particularly worsted spindles. The number of woolen spinning spindles decreased 58 percent during 1949-62 and the number of worsted spinning spindles decreased some 64 percent (table 16).

The South was important in processing wools on the woolen system before World War II, but the postwar surge of the textile industry to the South has made it even more important. In 1949, New England had 53 percent of the woolen spindles; the Middle Atlantic States, 24 percent; and the South, nearly 12 percent. By 1962 the corresponding proportions were 48 percent, 16 percent, and 28 percent. Based on wool trade claims, the relocation of the woolen industry is particularly important to an evaluation of possible scouring plant sites because woolen mills will buy scoured wool.

The shift of the worsted spinning industry from New England to the South was even more marked. In 1949, New England had 69 percent of the worsted spinning spindles in the United States; the Middle Atlantic States, nearly 23 percent; and the South, only 5 percent. By 1962 the South had increased its proportion to 62 percent, New England had decreased to 29 percent, and the Middle Atlantic States had fallen to less than 7 percent.

The average capacity of Southern spinning establishments, like Southern combing establishments, seems to be greater than their counterparts in New England or in the Middle Atlantic States. New England had 41 percent of the spinning, winding, and twisting establishments and 38 percent of the spindles; the Middle Atlantic States, 28 percent of the establishments and only 11 percent of the spindles; and the South, 21 percent of the establishments but 46 percent of the spindles.

The number of woolen and worsted looms in the United States decreased from 49,600 in 1939 to 11,407 in 1962. During 1939-58 the proportion of total looms located in New England declined from 69 percent to 44 percent; in the Middle Atlantic States, from 18 percent to 16 percent; but the proportion located in the South increased from 6 percent to 36 percent. The increased proportion in the South is not so much due to an increase in the number of looms as to the fact that the Southern States merely maintained their number while other areas did not (table 16).

The relative size of weaving establishments in New England, the Middle Atlantic States, and in the South follows the same apparent pattern as combing and spinning establishments; those in the South, on the average, seem to be the largest. In 1958 the South had 14 percent of the weaving, dyeing, and finishing establishments and 36 percent of the looms; New England had 43 percent of

Table 16.--Number of spindles, combs, and looms in place in the wool manufacturing industry, by geographic division, specified years 1939-62 1/

Item and year	New England	Middle Atlantic	North Central	South	All other	United States
	Number	Number	Number	Number	Number	Number
Worsted combs:						
1939	1,823	674	3/	95	3/	2,592
1949	1,915	671	3/	80	3/	4/ 2,720
1955	1,297	306	2/	416	73	2,092
1957	922	276	2/	343	28	1,569
1959	924	189	2/	379	34	1,526
1961	917	185	2/	438	35	1,575
1962	926	174	2/	475	39	1,614
Woolen spinning spindles:						
1939	986,253	464,451	175,065	154,024	31,976	1,811,769
1949	749,919	339,539	138,854	165,756	29,792	1,423,860
1955	409,953	184,815	76,664	135,094	10,728	817,254
1957	340,647	162,551	58,881	169,800	14,184	746,063
1959	336,211	132,966	55,007	174,584	13,104	711,872
1961	301,564	113,125	51,533	172,398	8,976	647,596
1962	280,970	92,084	41,669	167,312	8,976	591,011
Worsted spinning spindles:						
1939	1,564,044	484,930	40,856	40,448	10,780	2,141,058
1949	1,266,740	414,130	46,100	95,838	13,936	1,836,744
1955	442,906	152,494	2/	267,448	62,888	925,736
1957	267,674	69,234	2/	307,788	15,256	659,952
1959	246,000	68,482	2/	359,160	14,884	688,526
1961	224,374	41,440	2/	375,840	14,236	656,890
1962	192,192	43,268	2/	408,184	15,021	658,665
Woolen, worsted looms:						
1939	34,146	9,058	2,870	3,095	510	49,679
1949	21,695	8,090	2,532	4,654	522	37,493
1954	11,618	4,446	1,663	4,672	3/	22,399
1958	5,817	2,136	631	4,748	3/	13,332
1962	NA	NA	NA	NA	NA	11,407

1/ Data for 1939 are for May, all other years are for December.
2/ Data included in "all other" to avoid disclosing information of individual companies.
3/ Included in "South."
4/ Revised totals published in 1951 and 1958. These revisions were not carried through to the detailed figures by types, hence the detail does not add to the total.

Adapted from Bureau of Census reports, Census of Manufactures: 1954 and 1958, and Current Industrial Reports, Series M22 TE.

the establishments and 44 percent of the looms; and the Middle Atlantic States had 31 percent of the establishments but only 16 percent of the looms.

Summarily, the woolen and worsted manufacturing operations are moving South and indications are that this trend will continue. The more recent and most significant shift has been in the worsted segment of the industry, a relatively high cost operation. Also, the woolen and worsted establishments in the South, on the average, appear to be larger than those located in New England and considerably larger than those operating in the Middle Atlantic States. These averages are influenced by the absence of very small specialty-type plants in the South. No giant plants have been constructed in the South for mass production of serges or other standard goods. Large plants lack flexibility in production and cause too great an impact on communities during periods of depressed manufacturing activity.

V. THE BALING OF GREASE WOOL

The extent to which wool scouring operations located in the producing area can compete with one another and with the established Eastern scouring interests depends largely upon their possibilities of reducing wool marketing costs, which may largely involve differences in transportation costs. Baling wool prior to its being transported to the scouring plants or mills enables the shippers to request higher minimum weights which carry relatively lower rates. Through baling, motor carriers and water carriers are in a more competitive position with railroads. Motor carriers, particularly, have become keen competitors for wool shipments because through baling they can load larger tonnages, and in addition are not subject to ICC economic regulations when hauling grease or scoured wool in interstate commerce. Thus, baling may have a large impact on wool marketing and, from the standpoint of reducing transportation and other marketing costs, baling certainly is a supplement to and may even be considered as an alternative to scouring.

Baling grease wool is increasing in popularity but is not yet a common practice among warehouse operators in producing areas. Although millions of pounds of baled wool are imported annually, the wool trade has been somewhat reluctant to advocate baling domestic grease wool. Indications are, however, that the trade's position is changing (8). The information presented here was obtained primarily from 8 Western warehouse operators who are now baling grease wool.

Location and Practices of Baling Firms

The baling of grease wool may take either of 2 forms. The fleeces may be removed from the wool bag and baled to make a bale of fleeces or the fleeces may be left in the bag and 3 to 6 bags may be subjected to considerable pressure and bound together to make a bale of bags. The latter method of baling was developed by a Texas trucking firm about 1953 and is commonly referred to as the "Texas System" of baling domestic grease wool. Trucking firms employing this system are using special upstroke balers that were designed by a commercial baler manufacturer. The balers have only 2 feet of filling chamber below the trailer floor and are mounted on low-boy trailers designed for these presses (fig. 6). Some California truckers reportedly began using the Texas System in 1965.

BN-25218

Figure 6.--A motor-trailer mounted baler for compressing bags of grease wool.

The baling of grease wool in Texas was originally confined to a few large trucking firms who utilized balers mounted upon trailers and which may be transported from one warehouse to another. The Texas trucking firms also serviced wool warehouses in southeastern New Mexico. Now these firms also maintain balers at their freight yards and may concentrate the bags there for baling and shipment to the mills. In addition, some of the larger Texas warehouses reportedly are now installing regular balers of their own.

The Texas system, which uses mobile balers, quickly proved the value of baling from a transportation standpoint. In the 4 years, 1953-56, the transportation of the Texas and southeastern New Mexico wool clip to the mills switched from nearly all rail to all truck. The primary reasons for this, according to warehouse operators, involved: (1) lower costs, (2) faster delivery, (3) delivery at more than one mill or warehouse within a market area at no additional charge, and (4) occasional delays experienced in delivery of railroad cars (13).

By 1956, 6 wool warehouses had installed and were operating balers. These 6 operators baled more than 13 million pounds of grease wool that year (13). One of these was a cooperative that had been baling fleeces since 1944. Additional warehouse operators installed balers in Colorado, Missouri, and Montana in 1957, in South Dakota and New Mexico in 1958, and in Indiana and New Mexico in 1959.

In 1960, 8 of the 9 warehouse operators in the West who had installed wool balers were interviewed. Four of these operators, two in New Mexico and two in South Dakota, employed the Texas system of baling. All 8 operators stated that the major factor in their decision to bale was transportation costs. Also, baling greatly reduces the storage space requirements of warehouses and contributes to more efficient handling.

Contrary to widely held beliefs, such factors as whether the wool was warehouse owned or consigned prior to sale, grades and shrinkages of wool handled, and the extent of preparation prior to baling had no relationship to the kinds and amounts of wool baled at these warehouses. The 8 warehouses included 4 operators who handled only consigned wools, 3 warehouses that both purchased and consigned, and 1 that handled no consignments. All 8 indicated that the grades and shrinkages affected bale weights but not the decision as to whether or not to bale. None of the wool baled was graded or otherwise prepared prior to being received by the warehouse and the 4 warehouses baling bags did no preparation at the warehouse. The 4 remaining warehouses did some preparation prior to baling but only as part of their regular warehouse operations. One warehouse operator graded 24 percent of his volume; one graded 41 percent, and graded and skirted an additional 54 percent; one graded 90 percent of his volume (everything but lamb's wool); and one warehouse, owned by a processor, graded and sorted his entire volume.

The proportion of total volume that was baled at each of the 8 warehouses studied ranged from 50 to 100 percent. The 4 warehouses that graded, indicated that they baled all graded wool. But the balers operated by these grading warehouses would not accommodate bags of wools as in the Texas system, and the warehouses did not feel that the savings in transportation justified removing from bags fleeces which were not to be graded, merely to bale them. The tendency of cooperative warehouses to grade a larger proportion of their volume than other warehouses has contributed to their exerting some leadership in the baling of fleeces.

The extent of baling at the 4 warehouses employing the Texas system depended on a variety of factors. One operator in the Southwest, where 6- to 6½-foot bags predominate, reported that he baled all bags of these dimensions. Ten percent of his volume was received in longer, Territory-type bags (7 to 7½ feet) which would not fit his baler. Another Southwestern operator indicated that he baled all wool except that destined for nearby Texas warehouses or scouring plants. The 2 remaining operators using the Texas system of baling stated that rail rates had presently been reduced to the same level as truck rates and that the extent of baling depended on the choice of transportation and whether or not they were short of storage space in the warehouse.

The operators' opinions were obtained on the advantages and disadvantages of baling and its effect on such factors as damage from moisture and tags, core sampling, appearance of the fleeces, contamination, and acceptability by the mills. Operators indicated that baling not only reduced the requirements for storage space but also for labor. Labor crews were no longer needed to tier the bags (which often fell and had to be tiered again) and to load boxcars. One man and a lift truck replaced these crews. Also, record keeping was reduced since 1 bale took the place of several bags of wool, which formerly were

individually weighed, marked, and recorded. However, one operator stated that the efficiencies in labor were about offset by the cost of baling and that if rail rates were as low as truck rates, the only net advantage to baling was the reduced space requirements.

The operators stated that they had never received any unfavorable comments from buyers about damage from tags because of moisture or stain. However, fleeces should not be baled with excessively wet or "green" tags. Baling actually reduces the chance of external moisture damage. One operator reported that a shipment of baled wool that was caught unprotected in a heavy rainstorm was penetrated by moisture only to a depth of 3 inches, and had no burning problem and very little stain.

The ease and accuracy of core testing apparently is enhanced by baling. Six of the 8 operators made such claims, while the other 2 indicated that they lacked sufficient evidence for an accurate comparison. Much of the recent work of the Department of Agriculture Denver Wool Laboratory has been oriented to core sampling of baled wool (15). Baled fleeces are core tested by mounting a number of 3/8-inch tubes onto a receiving chamber and attaching the entire apparatus to a post or wall in the warehouse (fig. 7). In most warehouses, bales are handled with clamp lifts. In the sampling operation the lift truck raises the bale and pushes it against the multiple-tube coring apparatus, punching out 3 to 5 of the 3/8-inch core samples (fig. 8). In this type of sampling, further subsampling is unnecessary and the entire sample can be tested for clean wool fiber present. However, the coring of baled bags does not lend itself to sampling with the multiple-tube "post-punch."

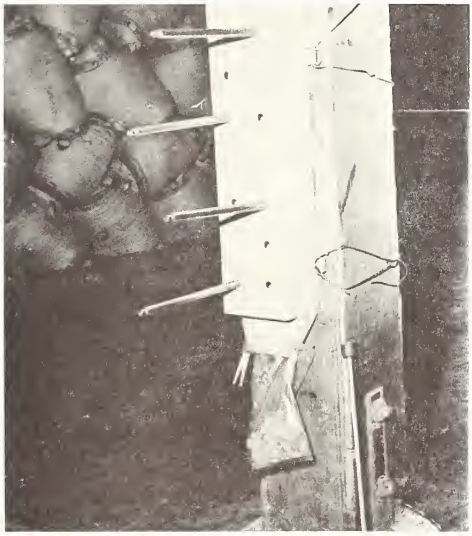

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Figure 7.--The 3/8"-pressure core tubes ("post-punch") and sample collection box.

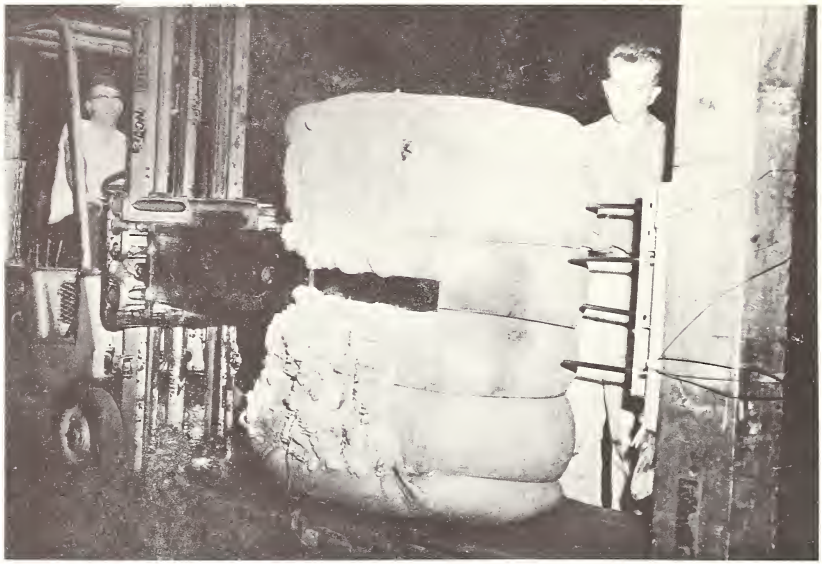

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Figure 8.--The core sampling of wool bales utilizing the "post-punch."

The appearance of the wool was not adversely affected by baling according to 7 of the 8 operators. Naturally, the wool looks a little "mashed" as one operator put it, when the bales are first opened, but the fleeces fluff rapidly and soon regain their lofty appearance. The one dissent was that the wool appeared higher shrinking after it had been baled. All agreed that baling decreased contamination from jute, dirt, and other foreign matter. The most surprising opinions voiced by the operators related to the mills' acceptance of baling. Five of the warehouse operators stated that the mill buyers had been recently indicating a preference for baled wool, particularly if the wool were completely covered. The 3 remaining operators said that mill buyers had shown no preference either way: bags or bales. This indicates a near complete reversal of the wool trade's opinion since the 1940's and early 1950's. The explanation may be that there are few dealers buying in Western warehouses today and little liklihood that the wools purchased and baled in producing area warehouses will be resold. Dealers who formerly purchased large volumes of western wools were afraid that baling decreased attractiveness and made them more difficult to resell. One large topmaker summarized his company's position by stating that they had never objected to foreign wools (which are baled), and that baling has no effect on noilage in either grease or scoured wool unless the wool is defective, i.e., is tender or has a break in it.

Labor Requirements, Facilities, and Costs

Numerous types and sizes of balers are available which may be used in baling fleeces or bags of wool. The 8 balers in this study included 5 regular commercial balers, 2 custom-made wool balers, and 1 converted cotton press. Three of the 5 regular commercial balers were portable downstroke presses. These 3 balers varied in cost from $2,400 to $3,650 (f.o.b. manufacturer), in weight from 3,300 to 5,300 pounds, and in horsepower from 5 to 7.5. Shipping costs from the Midwest, where the manufacturers of 4 of the 5 commercial balers are located, to Western warehouses averaged about $500. The baling crew, which usually is responsible for loading, baling, covering, and tying the bale, ranged from 3 to 4 men on the 3 portable, downstroke commercial balers. Two of these warehouse operators baled fleeces and indicated that their output averaged about 1 bale every 17 minutes; a little more than 18,000 pounds per 8-hour day with their average bale weight of 650 pounds. The density of the bales was 16.2 pounds per cubic foot for one of the operators and 17.6 for the other (table 17).

The third operator, who used a portable downstroke baler, baled only bags of wool. Using a $2,800 baler and a 4-man crew, he baled up to 100,000 pounds of bagged wool per day. The density of these operators' bales averaged 18 pounds per cubic foot. Two men are required at the top of the baler in this operation to place the bags lifted to them by a lift truck (fig. 9). The length of the baler chamber is critical in the selection of a baler if one is contemplating baling bags of wool. This operator, using a 5-foot chamber, baled the Texas-type bags with ease but could not bale the 7- 7½-foot Territory-type wool bags.

When baling fleeces, at least 1 man and sometimes 2 men are used on the top of downstroke balers, even when a conveyor system transports the fleeces from the warehouse floor or graded pile to the top of the baler. Two additional men cover the bale, place and tie the wires, and remove the bale from the baler chamber.

Two operators, one baling matchings and the other baling bags, used commercial upstroke balers. The balers were identical, weighing 12,750 pounds and costing $5,600, f.o.b. Midwest manufacturer. This type of baler may be filled at floor level by opening the doors and dropping or pushing the fleeces or bags of wool onto the pit on top of the ram.

The operator baling matchings, however, chose to leave the baler doors closed and load from the top, employing a conveyor arrangement (fig. 10), which fed the wool into a hopper. Wool could continue to accumulate in the hopper while the 2-man baling crew was applying the cover and wires to a bale (fig. 11), thus speeding up the operation. This operator's bales weighed about 900 pounds, with a compression of 26.7 pounds per cubic foot, the highest compression of any baler studied.

The operator using the commercial upstroke baler for baling bags employed 4 men in his crew; 2 working on each side of the baler, placing bags, pressing, and tying. The number of bags per bale varied from 4 on heavier shrinking fine wool to 7 on some of the lighter crossbred wool. An effort was made to keep the bale weights near 900 to 1,000 pounds, giving a compression of 20 pounds per cubic foot (table 17).

Table 17.--Description and cost of equipment and materials used in baling wool, and bale size and weight, 8 Western wool warehouses, 1960

Item	Unit	Baled in bags				Baled in fleeces			
		Warehouse A	Warehouse B	Warehouse C	Warehouse D	Warehouse E	Warehouse F	Warehouse G	Warehouse H
Baler:									
Weight	Pound	3,800	4,000	12,750	5,000	3,300	1/	5,300	12,750
Age	Year	2	3	5	1	4	1/	4	2
Horsepower	Number	15	60	10	7.5	5	1/	7.5	10
Cost (new) 2/	Dollar	3,800	5,500	5,600	2,800	2,400	1/	3,650	5,600
Bale wire:									
Gage	Number	13	13	12	12	12	12	12	13
Length	Inch	118	120	144	144	126	102	113	156
Wires per bale	Number	13	13	6	9	5	6	5	6
Eye and hook	Percent	100	100	0	0	0	100	100	0
Hook only	Percent	0	0	100	100	100	0	0	100
Cost per bale	Dollar	0.65	0.65	0.30	0.45	0.25	0.36	0.35	0.54
Bale cover:									
Pieces	Number	3/	3/	3/	3/	3	4	2	2
Coverage per bale	Percent	100	100	100	100	100	100	100	100
Cost per bale	Dollar	0	0	0	0	1.70	0.50	0.30	1/
Average bale:									
Dimension:									
Height	Inch	90	90	60	60	57	60	53	54
Width	do.	40	40	48	48	45	34	43	40
Depth	do.	30	30	30	30	27	30	28	27
Weight:									
Smallest	Pound	600	850	600	600	450	475	450	800
Largest	do.	1,400	1,300	1,300	1,500	900	800	1,000	1,200
Average	do.	1,050	1,050	1,000	900	650	600	650	900
Compression per cubic foot	do.	16.8	16.8	20.0	18.0	16.2	16.9	17.6	26.7

1/ Data not available.
2/ F.o.b. manufacturer.
3/ Additional covering not required for baled bags.

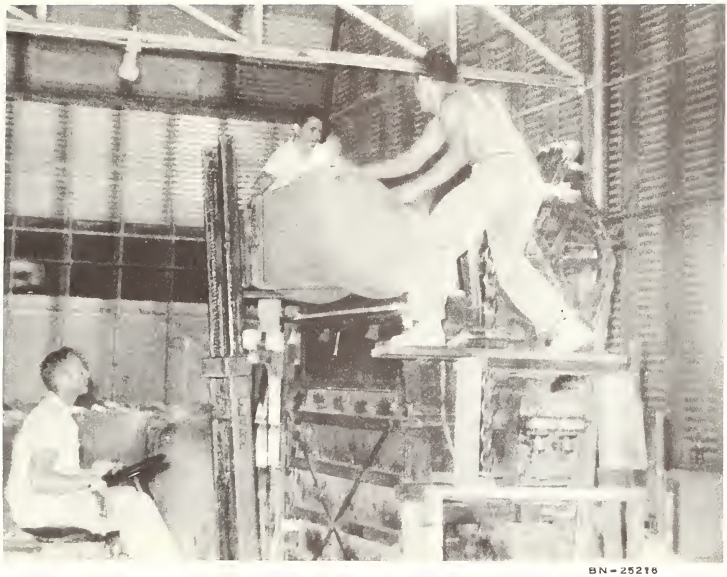

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Figure 9.--Loading a downstroke baler with bagged wool.

BN-25215

Figure 10.--An upstroke wool baler with a conveyor-top loading hopper arrangement

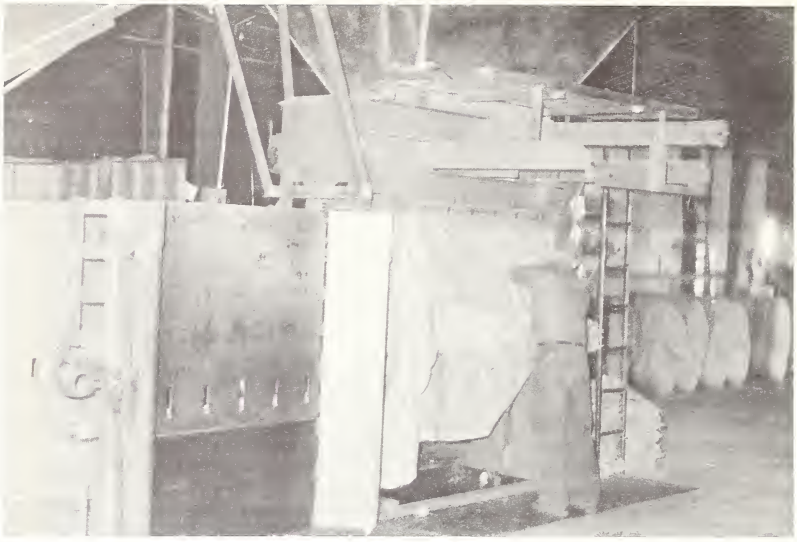

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Figure 11.--Applying the cover and wires to a compressed bale of wool in an upstroke baler. The overhead hopper can continue to fill during this operation

Upstroke balers usually come with a 10-foot depth chamber below the floor and the baler doors form a 6-foot chamber above the floor, giving a 16-foot active filling chamber when the balers are top-loaded. Baler companies can furnish any desired depth of filling chamber. 2/

Custom balers designed specifically for baling Territory bags of wool were used by 2 operators. The bags are stood on end in the chamber and compressed by a horizontal hydraulic ram (fig. 12). These balers weigh about 4,000 pounds, cost from $3,800 to $5,500, and are mounted on skids so that they can be moved about the warehouse and, in the case of one operator, from one warehouse to another. Two men were used to perform the actual baling operation, one running the baler and another hauling the wires. It kept 2 additional men with hand-trucks busy loading the baler and a lift-truck operator hauling the bales away. The bales averaged 1,050 pounds with a density of 16.8 pounds per cubic foot (table 17).

Two operators in the West, one of whom was interviewed, had adapted cotton presses to the baling of wool. The bales were standard-size gin bales (30 x 34 x 60 inches) but weighed about 100 pounds more than their cotton counterpart,

2/ Information supplied by H. T. McNally, Economy Baler Company, Ann Arbor, Mich.

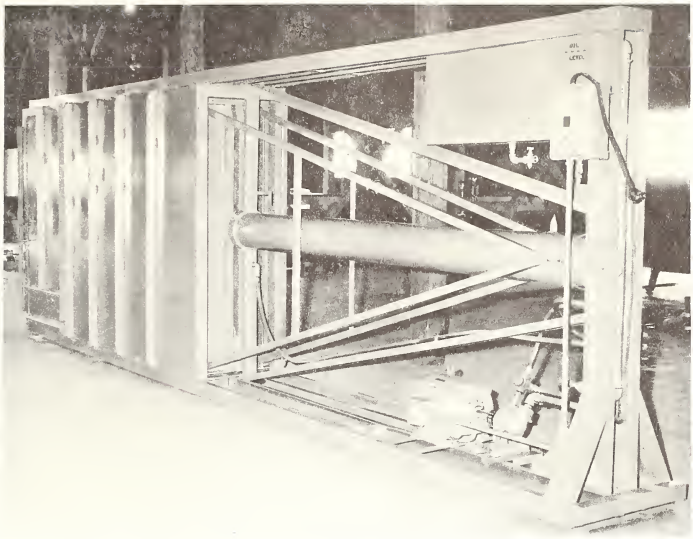

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Figure 12.--A horizontal baler for compressing bags of wool into bales.

averaging 600 pounds. The operators achieved a compression of 16.9 pounds per cubic foot (table 17). Like all cotton presses, these adapted balers had 2 chambers so that 1 chamber could be filling while a bale was being prepared in the other. Data relating to weight, cost, horsepower, and output of bales were not available.

In addition to the personnel required to operate the baler and cover and tie the bale, warehouse operators usually hired 2 employees to run the handtrucks bringing wool from its storage area to the baler and a lift-truck operator to transport the finished bale. Handtruck operators were usually part-time, hourly employees.

With such wide variations in balers and size of baling crews, and with some operators baling bags and others fleeces, what costs might one anticipate in establishing a baling operation? For most warehouses in the producing areas the costs would approximate $0.16 per hundredweight for baling bags of grease wool and $0.30 per hundredweight for baling fleeces (table 18). These estimated costs are based on information from plant operators and from baling equipment manufacturers.

An annual volume of 2.5 million pounds was assumed in computing the cost per hundredweight. Nearly a third of the warehouse operators in the United States, handling more than half the domestic wool clip, have an annual volume in excess of 2 million pounds (13). The 8 Western operators with baling

Table 18.--Estimated average cost per 100 pounds to bale 2.5 million pounds of bagged and fleece wool annually, by item, United States, 1965

Item	Cost	
	Baled in bags	Baled in fleeces
	Dollars	Dollars
Depreciation, equipment	0.0424	0.0496
Transportation and installation	.0080	.0094
Repairs and maintenance	.0040	.0050
Labor	.0720	.0867
Wire	.0360	.0360
Covers	1/	.1200
Total	0.1584	0.3027

1/ Covers not required for baled bags.

facilities in 1960 reported annual volumes ranging from 1.6 million to 4.5 million pounds.

Equipment.--The baling of bagged wool requires only a baler and clamplift truck in addition to the regular warehouse facilities and equipment. Baling fleece wool also requires these items, but in addition is greatly facilitated by having a conveyor to transport the fleeces from the warehouse floor to the top of the baler and a "hopper" located directly above the baler in which fleeces may be accumulated while a bale is being prepared.

A stationary pit baler costing approximately $5,600, f.o.b. Midwestern manufacturing point, was used in developing the cost data for baling both bags and fleeces. This price includes a 6-foot chamber above the floor with split doors and retainer dogs, a 10-foot chamber below the floor, and motor. The expanded bale dimensions are approximately 60 x 48 x 30 inches. The bales weigh about 1,000 pounds, assuming a density of 20 pounds per cubic foot. A 38-foot truck trailer can handle 44 of those bales and a 40-foot truck trailer, 48 bales. Railroads can haul 64 of these bales in a 40-foot car, and 76 in a 50-foot car.

A clamplift truck will cost about $5,000 and may be purchased locally. A 40-foot stationary conveyor system with stands and motor for baling fleece wool is estimated to cost $1,500. A portable conveyor system may be substituted to increase the flexibility of the baling operation but the costs will nearly double. The "hopper" attachment can probably be made by a local machine shop for about $300. Thus, assuming a 10-year depreciation on equipment and a 2.5 million-pound

annual volume, the equipment cost per hundredweight for baling bagged wool is estimated at $0.0424 and for baling fleeces, $0.0496.

Equipment repair and maintenance are estimated at $100 a year for the baler and clamplift and $25 a year for the conveyor arrangement. Assuming a 2.5 million pound annual volume, the repair and maintenance cost per hundredweight is $0.0040 for baling bagged wool and $0.0050 for baling fleeces.

Transportation and installation costs may vary widely depending upon location, pit depth, and soil structure. Shipping the type of baler described above from the Midwest to a Western city such as Denver will cost about $500. Installation costs of the baler, including the pit, are estimated at $1,500. Installing the stationary conveyor and hopper may cost an additional $350.

Labor.--Labor requirements differ with the method of baling even though the type and size of baler may be the same. Labor costs are estimated (table 18) on the basis of a 7-man crew for baling bags, and a 5-man crew for baling fleeces. The hourly wage rate for all crew members except for the clamplift operator is estimated at $1.25. A clamplift operator is considered semiskilled and is assigned an hourly wage of $1.50 in this analysis.

A 7-man crew for baling bagged wool, and utilizing the type of baler described above, can bale 100,000 pounds of grease wool in 8 hours, a 1,000-pound bale every 5 minutes. Two men are on each side of the baler assisting in placing the bags, compressing, and tying the wires. Two handtruckers bring the bagged wool to the baler and a clamplift operator handles the finished bales. The number of handtruckers needed depends on the distance between the bagged wool storage area and the baler. If this distance is great, the substitution of an additional clamplift may be desirable. If time is not too important, the crew size may be reduced to 3, with 1 man on each side of the baler and 1 clamplift operator bringing the bags to the baler and handling the finished bales.

A 5-man crew reportedly can bale about 60,000 pounds of fleece wool in 8 hours. Baling fleeces is somewhat slower than baling bagged wool, and 1 man on each side of the baler can keep up with the covering and tying operation; 1 will also operate the baler. A third member of the crew is the clamplift operator. Two men bring the fleeces from the grading or storage area and place them on the conveyor system leading to the baler. The ability of these 2 men to keep a sufficient volume of fleeces moving to the baler is influenced by the conveyor arrangement. The fleeces usually are transported in carts from the grading or storage area to the conveyor. Extra handling may be avoided by placing one end of the conveyor in a sloping recessment or pit in the warehouse floor. The carts may then be dumped in the recessment area and the fleeces will roll onto the conveyor.

Wire.--Wire costs are estimated at 36 cents per bale. Six wires, costing about 6 cents each, were used by operators baling bags and fleeces. A standard 12-gauge wire was the most popular. About half of the operators used pre-cut, 10-foot wire with eyes and hooks. However, variations in bale size sometimes caused a problem and 12-foot, eye-only wires appeared to be more satisfactory.

Covers.--Bale covers are required only in fleece baling operations and are made primarily from old wool bags. Two bags are adequate to cover one bale

completely. Assuming old bags can be bought for 60 cents each, the cost per bale for covering material is $1.20.

Transit Privileges for Baling

The availability of transit privileges may greatly influence the location of plants for both baling and scouring. The purpose of this section is to acquaint the reader with transit privileges for baling grease wool and related services at wool warehouses. For this purpose a transit privilege may be defined as an agreement between a carrier and a shipper to allow the stopping of a shipment for processing, in this case baling, and the subsequent reshipping of the processed commodity at a rate equal to or less than the rate from point of origin of the shipment to its final destination. The transit privilege, as the name implies, is a rate concession which a carrier may grant individual shippers. The development of transit privileges and their effect on plant location, is discussed more fully in the section (p. 72) relating to wool transportation.

The existing transit privileges at the 5 warehouses were similar. The example in appendix A shows a rail transit privilege; but with minor revisions it would be applicable to all modes of transportation.

Five of the 8 baling-point warehouse operators had requested and received transit privileges. One had privileges for both rail and truck while the others had authorization for rail shipments only. At the 3 warehouses where transit privileges were not authorized, 2 operators had not requested such privileges from the carriers; a third had, but had been refused.

Four of the 5 warehouses reporting transit privileges for rail shipments indicated all inbound wool movements by rail were shipped under transit authority. Only a small portion of the wool handled by the fifth firm having rail transit privileges was moved under transit authority. The one firm which had received motor carrier transit privileges was authorized to apply them only on those inbound shipments which had followed the published motor carrier tariff. Such inbound shipments accounted for a very small portion of the total shipments to his plant. Thus for all practical purposes the motor carrier transit privilege existed only on paper.

The benefits to be derived from any transit privileges are directly proportional to the extent of their application; and periodic revisions should be made in these agreements so that the transit privilege covers the desired type of movement. Also, the warehouse operators indicated that the wool buyers' lack of knowledge of existing transit privileges was a major limiting factor in the utilization of such privileges, and that the buyers arranged for the shipment of a large percentage of the wool moving through their warehouses. Unless a buyer is fully informed of the alternative transportation methods and routes, services, and costs which are available to each warehouse his selection of the most advantageous alternative would be a mere coincidence.

ICC Precedents and Current Rate Basis for Baled Wool

Trucking firms and warehouses have employed the Texas System of baling grease wool since 1955. But the idea of tying together a number of bags of wool to form a bale did not actually originate with this system nor with the trucking industry. Prior to 1912, bags of wool in southern California warehouses were bound together to reduce transportation costs for moving them to Eastern manufacturing points (11). For many years the tariff of rail carriers had provided that the rate for Pacific Coast to Atlantic seaboard movement would be less for baled wool than for bagged wool. Because there were no specific density requirements, the act of merely tying together 3 or 4 bags constituted baling. Obviously baling of this type did not increase the tonnage of wool a rail car could handle, but met the requirements for the lower rate.

During the same period, however, wool baling in northern California became more effective. Wool was removed from the bags, subjected to considerable pressure, and bound by coverings and ties to form rectangular bales with densities of 19 pounds and more per cubic foot. A 36-foot rail car could be loaded to 32,000 pounds. (The minimum for bagged wool at that time was 20,000 pounds). During the first wool rate case of 1912, the ICC suggested to the carriers that wool not be classified as baled unless a density of 19 pounds per cubic foot was attained and that a minimum weight of 24,000 pounds per car (36 foot) should be an additional requirement. Also, a rate structure for bagged and baled wool was authorized by the Commission with the baled rates to be set at approximately 85 percent of the bagged wool rate (11). This was quickly implemented by the carriers.

By November 1912, the Commission had received numerous complaints from shippers relating to the minimum weight and density requirements for baled wool. The shippers argued that although it was impossible to produce a density of 19 pounds per cubic foot without baling, rail cars could be loaded heavier with certain types of wool in bags than the minimum then specified for baled wool. The shippers contended that the carriers should transport the bagged wool at the lower baled rate when the baled wool minimum had been met. The Commission subsequently ruled that the shippers overlooked the fact that the average loading for most commodities, including wool, was considerably higher than the prescribed minimums and that if the baled wool rate were applied to bagged wool (when loaded to the baled wool minimum), the carriers' revenues would be reduced. Although in their ruling the Commission chose not to disrupt the principle of ratemaking applied to wool movements, they did suggest to the shippers and carriers the following alternative method of ratemaking which provided the basis of our present rate system:

> "It is evident that if some scheme were applied by which the rate properly decreased in proportion as the loadings increased, justice would be done between different shippers and between shippers as a class and the carriers. It is possible that some system of this kind will finally be applied to commodities where the weight, when the car is filled to its physical capacity, varies as much as in the case of this commodity, but these rates were constructed upon the other theory, and we are not satisfied that they impose any substantial hardships." 3/

3/ Interstate Commerce Commission Reports, Vol. 23, page 185.

This suggestion eventually became the precedent for ratemaking in many commodities in addition to wool.

Another organized drive to modify the wool rate structure was made during the late 1920's (10). Technological changes in railway equipment had made it possible to load in excess of 30,000 pounds of bagged wool in a car. This loading exceeded the minimum (24,000 pounds) for the lower baled wool rate and Western wool growers' associations petitioned the ICC, alleging unreasonable rates on bagged wool and undue preference to the shippers of baled wool. The complainants asked for elimination of the 19-pound density requirements on baled wool and that the baled wool rate apply to bagged wool. The complaint was eventually dismissed and for all practical purposes the wool rate structure remained a closed issue until after World War II.

The present rate structure is a result of a 1949 ruling by the ICC (9). Wool shippers suggested that carloading should govern rate determination, not density nor a combination of loadings and densities. After considerable testimony and deliberation the Commission held: "A restriction of rates in connection with any minimum so that they will apply only on shipments in bales of a specified density is unreasonable and should be discontinued." 4/ This decision by the Commission was a departure from the policy established in 1912 of attempting to provide an incentive for heavier carloadings through baling. An incentive for heavier loadings is still supplied by the ICC regulations but it takes the form of decreasing rates for increasing weights.

Optimum Bale Dimensions

All 8 warehouse operators interviewed were satisfied with their present bale even though the bale dimensions and weights differed among the firms. The warehouse operator is primarily concerned with problems of efficient handling and storage within his own plant. But what about the mill warehouse operators and other handlers of baled wool who may receive wool from many firms? If the bales vary widely, the efficiencies gained in handling, storage, and loading in a particular warehouse may be more than offset by the inefficiencies in the remainder of the marketing process. Efficiencies obtained by an individual warehouse in the utilization of its own bale would probably apply to any similar size bale. With this in mind, an attempt was made to evaluate bales of various dimensions.

Most wool warehouses have both truck and rail facilities available to them. But the wool bale has been largely designed for efficient handling by one or the other of these competing forms of transportation. The purpose of this section is to evaluate various bale dimensions that would most effectively load all the more prevalent sizes of both rail cars and motor carriers and still utilize present baling facilities.

The average dimensions, weight, and density of the bales shipped by the 8 operators interviewed showed some similarity to one another (table 17), and to those from other countries (39). The data were analyzed in combination with information relating to the existing practices of the various carriers (table 19) by the cooperating firms. The warehouses in tables 17 and 19 are comparable,

4/ Interstate Commerce Commission Reports, Vol. 276, page 59.

Table 19.--Maximum and average size of bagged and baled wool shipments from 8 Western wool warehouses with baling facilities, by type and size of carrier, 1960

Warehouse, and type and size of carrier	Bagged shipments				Baled shipments			
	Maximum		Average		Maximum		Average	
	Bags	Pounds	Bags	Pounds	Bales	Pounds	Bales	Pounds
Warehouse A:								
Rail:								
50' high	175	48,125	175	48,125	1/	1/	64	67,200
50' regular	175	48,125	175	48,125	1/	1/	64	67,200
Truck:								
40'	2/	2/	2/	2/	33	34,650	33	34,650
38'	2/	2/	2/	2/	30	31,500	30	31,500
Warehouse B:								
Rail:								
50' high	1/	1/	150	41,250	3/	3/	3/	3/
50' regular	1/	1/	150	41,250	3/	3/	3/	3/
Truck:								
40'	2/	2/	2/	2/	33	34,650	30	30,000
38'	2/	2/	2/	2/	33	34,650	30	30,000
Warehouse C:								
Rail:								
50' high	1/	1/	215	38,700	1/	1/	60	60,000
Truck:								
40'	1/	1/	135	24,300	37	37,000	30	30,000
35'	1/	1/	93	16,740	33	33,000	30	30,000
Warehouse D:								
Rail:								
50' high	1/	1/	4/ 250	4/ 45,000	1/	1/	75	67,500
40' high	1/	1/	160	44,800	1/	1/	55	49,500
Truck:								
40'	1/	1/	4/ 120	4/ 21,600	40	36,000	38	34,200
35'	1/	1/	4/ 100	4/ 18,000	34	30,600	32	28,800
Warehouse E:								
Rail:								
50' high	175	48,125	1/	1/	100	65,000	1/	1/
40' high	147	40,425	1/	1/	80	52,000	1/	1/
40' regular	110	30,250	1/	1/	1/	1/	1/	1/
Truck:								
40'	1/	1/	1/	1/	59	38,350	1/	1/
35'	52	14,300	1/	1/	52	33,800	1/	1/
Warehouse F:								
Rail:								
40' high	1/	1/	135	40,000	1/	1/	95	57,000
Warehouse G:								
Rail:								
50' high	150	40,000	1/	1/	110	75,000	1/	1/
50' regular	150	40,000	1/	1/	1/	1/	1/	1/
40' high	122	30,000	1/	1/	85	50,000	1/	1/
40' regular	122	30,000	1/	1/	75	43,000	1/	1/
Truck:								
35'	2/	2/	2/	2/	53	35,000	1/	1/
Warehouse H:								
Rail:								
50' high	150	43,500	140	40,600	88	79,200	1/	1/
50' regular	130	37,700	120	34,800	80	72,000	1/	1/
40' high	120	34,800	115	33,350	72	64,800	1/	1/
40' regular	100	29,000	95	27,550	72	64,800	1/	1/
Truck:								
40'	80	23,200	80	23,200	48	43,200	48	43,200
35'	70	20,300	70	20,300	42	37,800	42	37,800

1/ Unknown or data not available. 2/ Never used trucks for bagged wool movements. 3/ Never used rail for baled wool movements. 4/ 6-foot wool bag.

allowing limited comparisons of various bale sizes and present utilization of equipment capacity. For example, warehouse G reported that by producing a bale with dimensions of 28 x 43 x 53 inches and a density of 17.6 pounds per cubic foot (table 17), it was possible to load a 50-foot "high" rail car to some 75,000 pounds, a 40-foot "high" to 50,000 pounds, and a 35-foot truck trailer to 35,000 pounds (table 19).

In an attempt to arrive at a standard bale for the domestic industry, the following guidelines were used. First, the bales should be designed to load all basic transportation equipment to a maximum. Second, the bales should have dimensions that are within the capabilities of most baling equipment currently available. Third, the bales should be of a size and weight to permit utilization of present equipment in the loading, unloading, and storage of the wool bale.

Given the inside dimensions of the carrying vehicle, the optimum bale dimensions and stacking arrangement can be determined. However, various types and sizes of transportation equipment are used in the movement of wool. Rail cars are either 40 or 50 feet in length, and the inside height may be either 10 feet (a "regular" car) or 10 feet, 8 inches (a "high" car). The truck trailers commonly used to transport wool vary from 35 to 40 feet in length. The closed vans usually measure 8 feet in usable height while the open vans, or "rag tops," can be almost any height. For our analysis "regular" rail cars were selected because the "high" cars might not be available to many warehouse operators on quick notice.

Selection of the more significant truck trailers was not so simple. Some warehouse operators reported using a large number of 35- to 37-foot trailers. The trend, however, is apparently toward the 38- and the 40-foot trailers. Information obtained from the chief engineer of a large trailer manufacturer indicates that the number of 35- and 36-foot trailers used in the movement of wool is dropping rapidly and that there is practically no demand for trailers less than 37 feet in length. In the absence of a "standard" trailer, 3 trailer sizes were included in the analysis: The 36-foot trailer to represent the shorter trailers still in use, and the 38- and the 40-foot trailers which are gaining in popularity. Closed vans are used nearly exclusively in the outbound shipments from wool warehouses and were selected for setting the trailer height at 8 feet. Thus, 2 railcars and 3 trailers were selected. Within these limitations thousands of alternative bale dimensions in combination with various stacking arrangements were evaluated.

The analysis delineated or selected 14 bale sizes which offered the best possibilities, but there apparently is no one "best" bale which will load each of the 5 pieces of transportation equipment to a maximum. Assuming a constant density of 18 pounds per cubic foot, the 14 selected bale sizes lent themselves to grouping according to their relative advantages in loading the different pieces of transportation equipment (table 20). The dimensions indicated are those of the expanded bale and not the baler chamber. The density of 18 pounds per cubic foot is the mean density of the bales produced by the operators interviewed.

Bale dimensions included in Group A are relatively advantageous for an operator not particularly concerned with using 36- to 38-foot truck trailers.

Table 20.--Number and total weight of wool bales of given dimensions that can be loaded in trailer trucks and rail cars of specified sizes 1/

Bale size groups	Bale dimensions				Truck trailers, by size 2/						Rail cars, by size 3/			
	Depth	Width	Height	Volume	40-foot		38-foot		36-foot		50-foot		40-foot	
	Inches	Inches	Inches	Cu. In.	Bales	Pounds	Bales	Pounds	Bales	Pounds	Bales	Pounds	Bales	Pounds
A	31	48	60	51.66	48	44,604	44	40,915	42	39,055	76	70,632	60	53,568
A	31	48	59	50.80	48	43,848	44	40,234	42	38,405	76	69,480	60	54,864
A	30	48	60	50.00	48	43,200	44	39,600	42	37,800	76	67,536	64	57,600
B	31	48	57	49.08	48	42,444	48	42,444	44	38,871	76	67,104	60	52,992
B	31	48	56	48.22	48	41,688	48	41,688	44	38,190	76	65,952	60	52,056
B	31	48	55	47.36	48	40,932	48	40,932	44	37,509	76	64,728	60	51,120
B	30	48	57	47.50	48	41,040	48	41,040	44	37,620	80	68,400	64	54,720
C	31	48	54	46.50	52	43,524	48	40,176	48	40,176	76	63,576	60	50,184
C	31	48	53	45.63	52	42,710	50	41,076	48	39,420	76	62,352	60	49,248
C	30	48	54	45.00	52	42,120	48	38,880	48	38,880	80	64,800	64	51,840
C	30	48	53	44.16	52	41,334	50	39,744	48	38,124	80	63,576	64	50,832
C	29	48	54	43.50	52	40,716	48	37,584	48	37,584	80	62,640	64	50,112
C	28	48	60	46.66	48	40,284	48	40,284	48	36,936	80	61,416	64	49,176
C	28	48	59	45.68	48	39,636	48	39,636	48	36,288	80	63,504	64	51,408

1/ All weights based on bale density of 18 pounds per cubic foot.
2/ Closed vans with inside height of 8 feet.
3/ "Regular" cars with inside height of 10 feet.

For these, the bales described in Groups B and C are preferable. Those operators who use 38- and 40-foot truck trailers, but not 36's, will find Group B bale dimensions better suited to their needs. Variations in pay loads are similarly incurred in railcars and the operators who use all 5 pieces of equipment might find Group C bale dimensions to be more suitable (table 20).

To select a particular bale size that would be most advantageous to the industry as a whole, would require information relating to the sizes and extent of all the various pieces of transportation equipment that are used. In the absence of this information but from data available, it appears that the most suitable bale dimensions are those included in Group B, particularly the bale with dimensions of 30 x 48 x 57 inches. Such a bale, with a density of 18 pounds per cubic foot, properly arranged or stacked, will load a truck trailer of 38 feet or more to at least 41,000 pounds, a 50-foot rail car to 68,000 pounds, and a 40-foot rail car to nearly 55,000 pounds (table 20). Most States have maximum gross weight limits which are allowed motor carriers, and under the present limits the pay loads can seldom exceed 40,000 pounds.

The optimum stacking arrangement for the suggested bale is shown in figure 13 for both motor carriers and rail cars. A 50-foot "high" rail car and 40-foot closed van are illustrated, but the respective stacking arrangements apply to similar bales and vehicles.

To compute payloads of the selected bales using a density other than 18 pounds a cubic foot, multiply the cubic feet of the bale by the density in question. This will give you the average weight per bale, which can then be

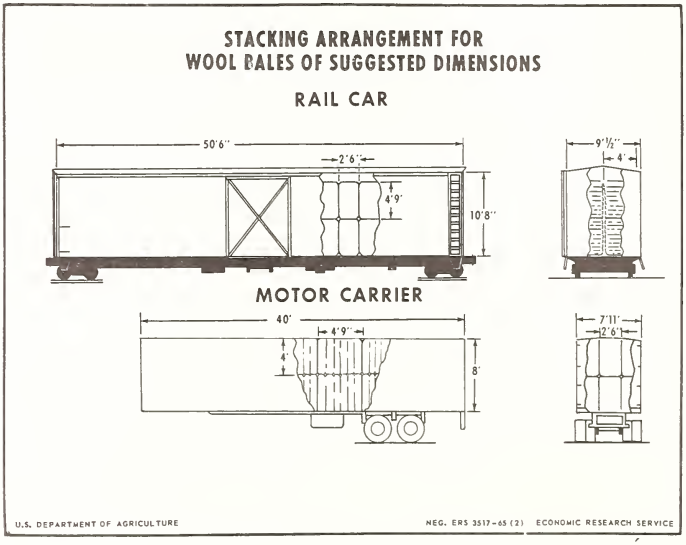

Figure 13

multiplied by the number of bales that can be loaded in the vehicle. For example, if the density of a bale of the suggested size (30 x 48 x 57 inches) were increased to 25 pounds per cubic foot, the average bale weight would be 1,187.5 pounds (47.5 x 25) and a 50-foot rail car could be loaded to 95,000 pounds (1,187.5 x 80).

The standard bale suggested in this report, or a similar bale, will provide greater overall efficiency in the transportation of wool. The reader should be cognizant, however, the recommended bale is not the optimum size for movements by each of the various pieces of transportation equipment. Our suggestion is provided with the hope that the wool industry and the transportation industry will take upon themselves the responsibility for selecting and adopting a standard size of bale for the movement of grease and scoured wool.

VI. WOOL SCOURING

Grease wool is scoured in 4 types of establishments in the United States. The type of scouring plant and the cost of scouring vary widely among geographic regions. Procurement and marketing problems differ. These factors and the capacity of the present wool scouring industry all have major implications relative to the advisability of expanding scouring facilities.

Types of Scouring Plants

The 4 types of plants in which wool is scoured are: commission plants, combing plants, yarn manufacturers, and fully integrated textile mills. Some of these may be under common ownership as subsidiaries or as branch plants, or their stock owned wholly or in part by mills who process their output. A complete enumeration of wool scouring facilities in the United States was made in the early 1950's (23). One hundred and five wool scouring establishments were reported. Eighteen were commission scourers, 15 combing plants, 13 yarn manufacturers, and 59 fully integrated textile mills.

Commission scourers scour wools belonging to others for a fee or commission. They may scour for wool growers, dealers, or processors. Their method of operation must be more flexible than that of the other 3 types of scourers. They must be able to adjust their operations to widely varying volumes of wool during the season and to scouring many different kinds or qualities of wool. They also perform more services than other scourers. Hence, their costs of operation are usually higher.

Some of the extra services they perform for their customers include free storage for a reasonable length of time before scouring and usually for 4 weeks afterward. A commission scourer may have a large proportion of his annual volume on hand at one time, all owned by his customers. Commission operators usually have some extra weighing and handling because the wool must be reshipped. The reshipment involves baling, a cost item that combers and mills may forego. In combing plants, yarn mills, or integrated mills, the freshly scoured wool may be blown from the drier to storage bins or fed directly to the cards. Mills usually bale their scoured wool only when they are pressed for storage space.

Commission scourers do considerably more "picking" than other types of scourers. This consists of picking out by hand the larger pieces of vegetable matter still embedded in the clean wool as well as stained pieces, black wool, wool from which the sheep branding fluid or paint is not completely removed, and cotts (small knots of matted wool). This may be performed by all scourers depending largely upon their own mill requirements. However, commission scourers, who usually have no idea of the end use of a particular lot of wool, must be more particular.

Commission scourers usually have more exacting limits than other types of scourers. They attempt to consistently leave 0.5 percent residual grease in the wool which assists in subsequent processing, and uniformly dry the wool to 12 percent moisture content for baling and shipment (23).

Commission scourers cannot accurately predict their volume of business since they usually have many customers. Consequently, commission plants are often relatively large. But their size may provide some economies of scale in labor, water, detergents, and other inputs along with increasing the feasibility of grease recovery. Thus, some of their higher costs may be offset.

Combing plants may or may not own the wool which they scour and comb, but their scouring operations resemble those of yarn manufacturers and integrated mills more closely than they resemble those of commission scourers. They may undertake commission scouring during slack business periods, but generally only when commission scourers are too busy. Combers often work with a 4-bowl scouring train instead of the 5- or 6-bowl trains common in commission plants and may not turn out as desirable a product. They are usually not as expert in the uniform control of residual grease and moisture content on all types of wools. They scour wool on commission as they would their own (23).

Without considering the extra services given by commission scourers, combing plants, yarn manufacturers and integrated mills can usually scour wool more cheaply. They operate more continuously and on fewer grades of wool. This specialization allows them to minimize the use of labor and materials. They need only to keep ahead of the carding machine and can avoid hiring extra labor for peak loads which commission scourers must meet.

The many small integrated woolen mills throughout the United States often do not have the generally lower costs of scouring associated with integrated operations. The scouring costs of these smaller mills may be higher than the fee charged by commission scourers. They rely largely on local sheep raisers to supply their small wool requirements, and freight rates often make it impractical to ship this wool elsewhere for scouring. Labor in such mills is usually not highly specialized and may be employed in scouring 1 or 2 days a week and the remainder of the time in the carding or dyeing room. For example, the operator of a small woolen mill in the West indicated that he scoured only 1 week a month and then for only 1 shift.

Plant Numbers and Locations

A complete enumeration of wool scouring facilities in 1953 listed 105 wool scouring plants or establishments in the United States (23). Fifty-four, or more

than half of all the plants were located in just 3 States: Massachusetts, Pennsylvania, and Rhode Island (fig. 14). Although of interest, the present number and location of all plants with scouring facilities was not considered critical to this study. Instead, the 1953 information is relied upon except in the area of prime consideration--the 11 Western States and Texas.

The wool scouring industry is still located primarily around 2 cities, Boston and Philadelphia. These areas are where most of the domestic wool clip was formerly assembled by dealers, and resold to mills. Also, the United States imports all the carpet wool it consumes and from 30 to 60 percent of the apparel wool (33, 34). And until the early 1950's, most of the imported apparel and all the carpet wool entered this country through the ports of these 2 cities. Boston had an early lead in importing wools for the first New England mills and developed highly specialized sales, financial, and storage facilities that made it convenient to buy wools through dealers on Summer Street.

This situation, as discussed previously, is now changing. While Boston remains the sales and financial center of the domestic wool industry, the actual mill operations are moving south, primarily into the Southern Piedmont. The implications of this trend are now becoming evident in the West.

Since World War II, and particularly during the late 1950's and early 1960's the number, locations, and type of scouring plants in the West have changed. Prior to 1945, 8 scouring plants were located in the West and all but 1 were operated by local mills. (Some additional scouring facilities in the region were confined to wool pullery operations of parent companies.) Four of the 7

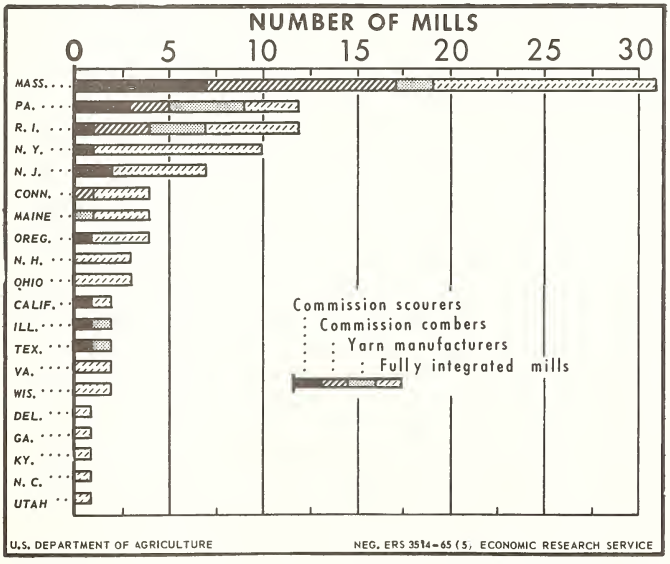

Figure 14.--Geographical distribution of wool scourers, United States, 1953.

mill-owned plants were in Oregon, primarily in the Portland area, two were in Utah, and one was in Texas.

In the late 1940's, one of the present Texas commission wool scouring plants was built. In the mid-1950's another followed. Two more plants were built in Texas in 1962 and 1963, both doing some commission work (25, 26). A commission scouring plant commenced operations in Colorado in 1959 and another in Wyoming in 1961. Thus, the recent installations are mainly for commission scouring and have been located primarily in Texas and the lower Rocky Mountain region.

But this activity in building new scouring facilities in the West does not mean that these and other plants have succeeded or will succeed. The present status of the wool scouring industry in the West has been a long time coming about and many plants have fallen by the wayside. Documented failures go back as far as 1891 in San Angelo, Tex. (27). Others that have failed include plants at Echo, Oreg.; Marble Falls, Tex.; and Denver, Colo. A longtime commission scourer in California liquidated in the late 1950's. The mill-affiliated Texas plant burned in 1959 and has not resumed operations. One of the four Oregon plants was liquidated in 1962 and the Wyoming plant, installed in 1961, ceased operations the following year.

The significant woolen and worsted mill operation which has been emerging in the South has important implications as to feasibility of operating scouring plants in the West and Texas. As late as 1950, both the grease and semiprocessed wool used by Southern plants was obtained almost entirely from Northern wool markets. Worsted mills purchased tops through dealers or branch plants in the North. Up to that time no worsted mill in the South produced all of the tops it consumed, and all except a few of the largest woolen mills (having their own scouring plants) purchased scoured wool from Northern dealers. Thus, the flow pattern for raw wool to the Southern wool processing plants was from the West and other producing areas to New England for concentration, preparation (usually scouring) and possibly other processing, and then to the South for manufacturing.

Although 59 woolen and worsted mills were operating in the South in 1951, there were practically no scouring facilities in the South. However, as the Southern wool processing industry continued to grow during the 1950's, the volume of wool consumed increased to such an extent that the construction of scouring plants in the area was inevitable. By 1960, 3 of the larger topmakers had built combing plants with modern scouring facilities in the South. All 3 of these plants are within 100 miles of Charleston, S.C., which is becoming a major import point for raw wool (12). While the information available is not complete, there apparently are no strictly commission-type scouring plants in the South, and it is this void, to a large extent, that recent plants in the West and Texas are attempting to fill. It seems likely that the scouring industry will continue to relocate in an effort to adjust to the shifting location of the manufacturing industry and thus reduce the long transits of wool from the producing areas to the South via New England.

Industry Capacity and Its Utilization

The volume of wool scoured annually in the United States varies considerably. We produce only a part of the wool we consume, and most of the wools our

mills import enter Eastern ports as grease wool. On the other hand, the in-place scouring capacity of the domestic wool industry is fairly stable.

The domestic wool industry now scours some 600 million pounds of grease and pulled wool annually. Exact figures are not available but an approximation may be obtained by consideration of the annual imports and domestic production of both grease and pulled wool (table 21). Exports are negligible and changes in trade inventories do not appear to affect significantly the volume scoured annually. Apparel and carpet wool inventories of dealers and manufacturers on January 1 for the 5 years 1960-64 averaged 129 million pounds, clean basis, and the greatest deviation from the average was only 22 million pounds. About 60 percent of this volume is held in an unscoured form. Mohair, like wool, is scoured prior to processing. But 2 factors limit the importance of mohair as a source of income to wool scouring plants: About two-thirds of the some 20-25 million pounds of mohair produced annually is exported unscoured, and mohair, unlike wool, contains only some 20 percent impurities which are removed by scouring. Also, over 95 percent of the domestic mohair clip is produced in one State, Texas, and a plant specially designed to scour and process mohair has recently been built in San Angelo (24).

The dependence of our wool textile industry on imports gives one firm reason for the industry's reluctance to move away from seaport facilities. For the 10 years 1955-64, imports of wool, both carpet and apparel, grease basis, were considerably higher than the volume of shorn and pulled wool produced domestically. On a clean basis, for the same period, the significance of imports is even greater. Because of the relatively high yield of carpet wools, all imports on a clean basis were the equivalent of 180 percent, or nearly double, the production of the domestic wool growing industry.

The total scouring plant capacity in the United States does not vary nearly as much as the volume of wool scoured. Wool scouring trains are all built to order by one of two manufacturers in the United States (23). The equipment represents a considerable expense, and has a long operational life. When scouring plants are liquidated, the trains often are sold to other wool scourers. Much of the scouring equipment in the West is from liquidated Eastern mills.

An estimate of the scouring capacity of the United States indicates there are some 200 wool scouring trains throughout the country (23). The consensus of scouring plant operators interviewed was that each train, on the average, can handle some 1,000 grease pounds of wool per hour. If all of these trains were operated as some of the more successful plants are, 3 shifts a day, 6 days a week, 50 weeks a year, they could handle about 1.4 billion pounds of grease wool. Considering that many of the newer trains handle 2,000 pounds per hour, and some up to 3,600 pounds, the estimate of 1.4 billion pounds is probably quite conservative. Existing capacity, if fully employed, is far in excess of any postwar requirement (34) and more than double that required to scour the wools our mills have consumed in any year since the Korean action (table 21). Thus, ample wool scouring capacity presently exists in the United States to meet any foreseeable need, but the problem lies in its location and availability. A large proportion of the wool produced in the West is still scoured in the East. The volume of this wool that may be diverted to a new plant will be greatly influenced by the plant's procurement and marketing practices or type of operation.

Table 21.--Imports for consumption and domestic wool production, United States, 1955-1964 1/

Year	Imported 2/				Domestic production				Total consumption	
	Apparel 3/		Carpet 4/		Shorn		Pulled			
	Actual weight	Clean content	Actual weight	Clean content	Actual weight	Clean content 5/	Actual weight	Clean content 5/	Actual weight	Clean content
	1,000 pounds	1,000 pounds	1,000 pounds	1,000 pounds	1,000 pounds	1,000 pounds	1,000 pounds	1,000 pounds	1,000 pounds	1,000 pounds
1955	169,054	112,764	185,958	135,979	241,284	106,165	41,600	31,200	637,896	386,108
1956	151,839	103,828	193,217	143,053	242,177	106,558	40,500	30,375	627,733	383,814
1957	111,809	78,207	161,976	120,996	239,101	105,204	33,600	25,200	546,486	329,607
1958	97,130	67,081	160,949	122,587	243,713	107,234	30,400	22,800	532,192	319,702
1959	146,177	100,517	248,978	191,642	259,939	114,373	34,500	25,875	689,594	432 407
1960	106,921	74,266	202,439	153,904	265,480	116,811	33,600	25,200	608,440	370,181
1961	130,095	90,318	205,946	157,335	261,249	114,950	34,500	25,875	631,790	388,478
1962	181,256	125,780	181,090	143,460	248,538	109,357	29,900	22,425	640,784	401,022
1963	155,120	109,196	213,407	167,962	238,185	107,183	28,800	21,600	635,512	395,837
1964	139,399	98,415	143,719	113,932	221,897	99,854	25,100	18,825	530,115	331,026
Average	138,880	96,037	189,768	145,085	246,156	108,769	33,250	24,938	608,054	373,818

1/ Adapted from reports of Department of Agriculture (33, 34).
2/ Includes pulled wool.
3/ Includes all dutiable wools.
4/ Includes all duty-free wools.
5/ Yields estimated by Department of Agriculture.

Procurement and Marketing Alternatives

The primary question to be answered in regard to the feasibility of establishing a new plant is "How much wool can be procured for scouring at a proposed plant and what are the potential market outlets?" Success of a new plant may well depend upon the nature and extent of preparation and blending practices which are directly related to type of operation. Information presented here focuses on this question; some pitfalls are noted and alternatives are suggested.

Most of the wool produced in the West and Texas is of sufficient length to be processed on the worsted system. The importance of proper preparation and blending of wools, particularly to worsted manufacturers, cannot be overestimated. Wool varies widely in grade, staple, and other quality factors. For example, during World War II, a manual was prepared by the Australian and British Governments delineating the various types of wool produced in Australia. More than 1,000 types were noted and described in Australia alone (1). Requirements of mills for the different types of wool are guided by an almost limitless variety of end products. The problem is to get the two together in such a way as to most fully utilize the quality characteristics of a particular lot of wool. While the variations in wool are associated with the types and breeds of sheep, wide variations of quality factors exist within the breeds, and considerable variations may exist within the fleece of a single sheep. How then, and when, should a particular lot of wool be prepared and possibly blended with other wools so that it may be processed most advantageously?

It has long been maintained by the members of the wool trade that the scouring of wools by growers, wool warehouses including cooperatives, wool dealers, and other nonprocessors prior to sale, may limit the market outlets for the wools to manufacturers of woolens, nearly always a lower priced market. Topmakers and worsted manufacturers buy and use grease wool almost exclusively because of the more rigid requirements of combing operations. To arrive at suitable blends, they like to purchase, prepare, and blend grease wool to meet specifications before it is scoured. Once wool is scoured, it is extremely difficult to evaluate its various characteristics and to determine how efficiently it will comb. Large amounts of undetected short fibers may be present in scoured wools (7). Also, wools scoured at different times or locations may take dyes differently.

Woolen operators, on the other hand, are not confronted with the combing operation nor to a degree, the uniform blending problems of the worsted division. The topmakers and worsted mill spokesmen have also maintained that long shipments of scoured wool in bales, such as from the West to Eastern mills, is injurious to the fibers and increases their percentage of noilage during the combing operation. Thus, a potential scouring plant operator should thoroughly investigate the types (woolen or worsted) of wool which would most likely be available to his plant before attempting to formulate his procurement and marketing policies. Failure to do so has proven fatal to some wool scouring ventures in the West.

A scouring plant has many possibilities: It may purchase its entire volume for resale; become affiliated with a textile mill and scour wools only for that mill's account; scour wools on commission for one or more textile mills; scour wools on commission for growers, warehouse operations, and other nonmill interests; or any combination of these. If satisfactory arrangements can be made

whereby the scouring plant will be owned or otherwise affiliated with a mill whose buyers will procure, assemble, and ship the wool to the plant for scouring and whose manufacturing operation is committed to take all the output, both the procurement and marketing problems will have been solved. These affiliated mills also will provide the scouring plant explicit instructions for preparation, blending, and scouring. This alternative was employed by 6 of the scouring plants in the Western States and Texas in 1960, although 1 of the 6 did some commission scouring for local warehouse operators during slack periods. One of the two plants opened in Texas during 1963 is also mill affiliated but undertakes some commission scouring (26).

The opportunities to utilize this alternative, however, are relatively limited. The textile mills in the West are few and small. They have already constructed their scouring facilities or made other arrangements to meet their requirements. Data from the 5 Western scouring plants selected for study indicate that mill-affiliated plants, while more numerous than commission-type plants, scoured only half as much wool (table 22). In addition, few Eastern dealers, topmakers, or mills purchase a sufficient quantity of Western wool within a small enough area to justify the construction of a wool scouring plant to meet their individual needs.

An alternative to mill affiliation is for the scouring plant to operate as a dealer, but this would greatly increase the capital requirements. And experience indicates that when a wool scourer attempts to become a wool purchaser and a scoured wool salesman, he is asking for trouble which can be avoided by more carefully planning the plant's operating arrangements and procedures. As a

Table 22.--Ownership and volume of grease wool scoured at 5 wool scouring plants, 11 Western States and Texas, by type of scouring plant, 1959

Ownership of wool	Type of scouring plant		
	Mill affiliated	Commission	Total
	1,000 pounds	1,000 pounds	1,000 pounds
Own account	1/ 10,410	976	11,386
Commission	840	24,174	25,014
Manufacturers	--	5,302	5,302
Growers	--	130	130
Warehouses	2/ 840	18,742	2/ 19,582
Handler	--	1,165	1,165
Dealer	--	17,577	17,577
Total	11,250	25,150	36,400

1/ Includes 180,000 pounds of imported wool.
2/ 840,000 pounds scoured for warehouse with undisclosed type of operation.

grease wool purchaser, the plant will be in direct competition with other dealers and with the topmaker and mills. A buying staff will be required, along with relatively large warehousing facilities. And with all this, the plant manager will not have solved, but will have compounded his marketing problem. He is in the position of competing for grease wool with his scoured wool customers and of merchandising the scoured wool to them without knowledge of their specific quality requirements.

Commission scouring represents another alternative. The important question is, "Commission scouring for whom?" Failures of early plants at Las Vegas and Albuquerque, N. Mex.; Pueblo, Colo.; and Pendleton, Echo, and The Dallas, Oreg., have been attributed largely to their reliance on wool growers to consign wool to them for scouring and sale. Other contributing factors were the higher freight rates on scoured wool shipments by railroads--the only long-distance mode of transportation available to these plants, and a "higher scouring cost in the West (19)"

Two recently established Western plants have encountered difficulty by depending on consignments from individual wool growers for their volume; one plant finally closed during 1963. These plants apparently were not able to merchandise the scoured product effectively, and grower support waned. Generally, worsted-type wools were scoured and then sold through Eastern wool brokers primarily to dealers and woolen interests because they had been scoured without knowledge of the preparation, blending, and scouring requirements of the topmakers and worsted mills which might have used them more advantageously. In the absence of standard industry requirements, there apparently is no way to obtain meaningful specifications without knowing which mill is going to purchase and process the wool.

Considerable success has seemingly come to those Western plants which have concentrated their efforts in the area of commission scouring for mills, topmakers, and dealers. This alternative solves both the procurement and marketing problems of the scourers because the mills, topmakers, and dealers furnish the wool along with all pertinent instructions for preparing, blending, scouring, and shipping. The problem is to solicit sufficient accounts from the Eastern interests to justify the operation of a scouring plant.

Procuring accounts for commission scouring, particularly from the topmakers and worsted mills is not easy. The mill interests claim that practically none of the wool scoured for them at commission-type plants is combed, and this claim was supported by the plant operators in the West who indicated that most of their accounts were with wool dealers (table 22), and that only a "small amount" of that scoured for manufacturers was combed. The operators of 2 Eastern commission plants who were interviewed reported similar information except that manufacturers' accounts were somewhat more important than to Western operators.

However, the amounts of worsted or combing-type wool produced in the West and the importance of topmakers and worsted manufacturers as purchasers of this wool, indicate that topmaker and worsted mill accounts may be available. Information presented previously (table 5, p. 11), indicates that Staple and French combing predominate Western wool production. About 60 percent of the wool produced in the 11 Western States and practically all the Texas wool clip is marketed through local warehouses. And topmakers and worsted manufacturers purchase about

85 percent of the wool sold at warehouses in the 11 Western States and about 40 percent of that sold through Texas warehouses (13).

The data obtained from 5 Western wool scouring plant operations indicate that about 30.5 percent of their volume was Staple and 45 percent, French combing--a total of more than 75 percent of sufficient length to be combed (table 6, p. 13). Considering only that wool scoured at Western commission plants, 18 percent of the volume was Staple and 53 percent, French combing. More than 5 million pounds was scoured on commission at Western plants for manufacturers (table 22).

It also appears that the fear of topmakers and worsted mills that the baling and long shipments of scoured wool tends to increase noilage may be ill-founded. Recent industry research does not support the claim of some combers that the long transits of baled scoured wool result in fiber breakage during subsequent carding and combing operation and decrease the proportion of top obtained (21).

To solicit trade accounts effectively would require knowledge of which dealers, mills, and topmakers are purchasing wool in the supply area of the location being considered, of how much wool they purchase, where it is now shipped for scouring, and the location of the respective mills. Then transportation savings, if any, associated with the proposed plant could be computed. Suitable facilities, qualified personnel, equitable scouring charges, and confidence of the trade are also important factors in obtaining accounts. Mills absolutely do not want technical information relating to their wools or operations discussed with other accounts. Mills and dealers also prefer that the commission plants limit their operations to commission scouring. Scouring plant operators are in the unique position of determining the actual yields of all the wools passing through their plants. A scouring plant operator who also purchases wools would actually be in direct competition with mill and regular dealer patrons, but would have the advantage of a wider knowledge of this important pricing variable for wools in his area.

Summarily, proper wool preparation and blending is critical to a successful wool scouring operation and the "proper" aspect is directly related to a plant's procurement and marketing policies. Industry standards for preparation and blending do not exist; each mill has its own requirements and even these vary from time to time. Thus, in the near absence of a Western mill industry with which to affiliate, it appears advisable that a potential scouring plant operator first explore the possibility of commission scouring for established Eastern trade interests, dealers, topmakers, and mills. If such arrangements can be worked out, the plant's procurement, preparation, blending and marketing problems will be largely solved.

Income and Costs

The sources of income to a scouring plant vary with the type of operation and the services performed. Plants operated by topmakers, mills, and yarn manufacturers usually scour only those wools belonging to the parent company and, as such, have no cash income from scouring services. On the other hand, the charges for the services performed at commission wool scouring plants are fairly uniform and provide a basis for much of following plant-income discussion.

The determination of wool scouring costs presents more of a problem. Variations in type and size of operation and in the accounting procedures of the plant operators interviewed made it advisable to develop a "model" scouring plant as a basis for estimating costs.

Income

Income to a wool scouring operation usually comes from no more than 5 sources: Preparatory services, scouring services, the sale of wool grease, the sale of wool salvaged from in and around the trains during clean-up operations, and wool storage.

All wool scouring plants perform some preparatory services prior to scouring. The nature and extent of preparation depends upon the variations within the original lots and the specifications for the scoured product, which are related to the end product for which the scoured wool is to be used. All commission scourers who were interviewed but one reported that their customers gave them either specific grading, sorting, and blending instructions, or specifications that the scoured product must meet, and in the latter case, the plant operator used his discretion in preparing the wools to meet these requirements. The one exception was a plant operator who was scouring wool for the growers. In the absence of mill- or dealer-supplied specifications, he was trying to prepare all wools so that they could be utilized in establishing a few scoured wool "types" or "lines" to be merchandised through a Boston wool broker.

All but one commission plant operator specified that grading and sorting charges would be quoted upon request but generally the charges are "labor cost, plus 10 percent." The one firm which had standard preparation fees charged 1.25 cents per grease pound for grading, and 1.75 cents per grease pound for sorting. Many lots must be graded before they can be adequately sorted, in which case the charge would be 3 cents per pound.

Scouring charges were fairly uniform among the commission plants throughout the United States, ranging from 3 to 3.5 cents per grease pound for wools shrinking 50 percent or more and from 3.35 to 3.75 cents per grease pound for wools shrinking less than 50 percent. Plants located in the West tended to charge less than those in the East. An additional charge of 0.4 to 0.75 cents per grease pound was made if a special bleach was desired. Excepting the income from the sale of crude lanolin, the operators reported that 60 to 90 percent of their plant income was derived from scouring fees.

Most of the wool produced in the West shrinks in excess of 50 percent. This is particularly true of wools produced in such States as Texas, New Mexico, Colorado, Wyoming, and Utah. As such, the income from scouring charges would probably be about 3.35 cents per grease pound.

The economics of recovering wool grease (crude lanolin) from the scouring liquors depends upon the volume and types of wool scoured and the market price for the grease. Not all plants attempt to recover this scouring byproduct. There are only about 9 companies in the United States that refine wool grease into lanolin and the market is highly erratic (23). An average price for most of the centrifugal wool grease available at domestic scouring plants is probably around 10 to 15 cents per pound.

Wools differ considerably in their grease content and not all the grease is recoverable. For example, a scouring plant might expect to recover as high as 9 percent dry grease, by weight, from Australian wools; 4 to 6 percent from Texas wools; 3 percent on Wyoming wools; 0.5 to 2.5 percent on domestic 3/8 and 1/4 Blood wools; and 0.5 to 3 percent on pulled wools. It was authoritatively estimated that the value of wool grease recovered from a plant operating 3 shifts per day should about pay the cost of scouring (chemicals, steam, water, and labor). 5/

A minor source of income to scouring plant operators results from their cleanup operations. During the scouring process some small pieces of wool are invariably lost in the bottom of the scouring bowls and in and around the feeder, drier, and other equipment. This waste includes mostly stained, cotted, and other inferior wools. It ranges from 1 to 5 percent of the grease wool, depending on whether it is a long-staple lot which hangs together well or something like a short Texas fall wool, which scatters more in handling. There is usually no way to establish ownership of this wool and consequently, the plant operators usually sell this for their own account after a sufficient volume has been accumulated. Such a mixture of wool is usually highly variable in physical characteristics, and its sale returns little income to the plant.

Wool storage is not an important source of income. Free grease wool storage is provided by commission scourers in the West for 60 to 90 days, in the East, for usually 30 days. Scoured wool is stored free in the West for 30 days and the East for 15 days. Other arrangements may be made with an individual plant operator depending upon the space available, but the scouring plant operators indicated that they are not in the warehouse business and only maintain wool storage facilities necessary for their scouring activities.

Costs

To answer the question, "What does it cost to scour a pound of wool?", a potential plant operator must first answer the following questions:

1. What volume of scouring is expected?
2. How dirty is the wool?
3. How clean will it be when scoured?
4. What method of scouring is to be used?
5. What equipment is to be used--new, large-scale, modern equipment, or accumulated pieces and parts from closed plants?
6. Will operations be on a 1-, 2-, or 3-shift base?
7. Is the proposed plant location in or near a community where transportation facilities, electricity, labor, and other requirements are available, or in an area where they may be limited?
8. Is wool to be scoured on a commission basis or as a department of a vertically integrated mill?
9. Will the scouring effluent require treatment before discharge into a sewer or public waterway?
10. Is the wool grease to be recovered?

5/ Information furnished by Thomas N. Crowley, Textile Chemical Division, Amchem Products Inc., Ambler, Penn.

Most scouring trains in the United States are operated by topmakers and manufacturers, and scouring is only one of the many processes in the production of tops, yarn, or cloth. These establishments allocate their costs on the basis of the number of balls of top, pounds of yarn, or yards of cloth. Because of this, it is difficult to allocate a portion of total cost to the scouring operation on an equitable basis. Even the same types of plants do not have identical bookkeeping systems; thus, items under the same headings may refer to different types of expenditures. Fiscal years do not correspond with calendar years and there are many difficult-to-decide, borderline cases as in any other area of accounting. The allocation of costs is particularly difficult in this industry because the commission scourer, who is the only one whose costs can be directly allocated to a pound of grease wool or clean fiber, is not typical of all other scourers as to size and method of operation.

To overcome these problems, the physical requirements for wool scouring that were developed in an intensive study of wool scouring relating to the economics of wool-grease recovery (23) are used along with information obtained from plant operators during this study and from wool-scouring equipment manufacturers. Current value or costs are assigned to the physical inputs. The physical requirements and cost estimates relate to the emulsion method of scouring--the only method presently in commercial use.

Primary emphasis is on developing cost estimates for a commission scouring plant. Differences in cost of scouring would be a minor consideration in developing a complete wool mill in the West. In building a scouring plant in the West affiliated with a mill located away from the site, say in the Southeast, costs would closely approximate those of a commission scourer. A 10-million-pound volume is the minimum volume recommended by wool scouring equipment manufacturers for a commission plant and this is the volume for which physical input requirements have been developed (23). The influence of volume on equipment and other costs is indicated whenever adequate information is available.

Equipment.--There are many combinations of scouring trains and supporting equipment which are capable of handling 10 million pounds of grease wool annually. The 3 basic train widths are 48, 60, and 72 inches. The 48-inch train has a rated hourly grease wool capacity, assuming a 50-percent shrinkage, of about 2,000 pounds, and by operating on a 3-shift basis should be capable of scouring about 10 million grease pounds annually. Seven of the operators interviewed were using one or more 48-inch trains but only one reported achieving the rated hourly output of 1,000 clean pounds per hour. The other 6 operators reported hourly volumes ranging from 1,000 to 1,500 grease pounds per hour--far short of 10 million grease pounds annually. Two 48-inch trains would be capable of scouring a total of 10 million pounds, but their cost would be nearly double that of purchasing one 60-inch train which can scour 10-million pounds annually. The 60-inch train is the most frequently ordered train today and has an hourly rated grease wool capacity of about 2,600 pounds, and by operating on a 2-shift basis can easily handle 10 million pounds of grease wool. The 72-inch train has an hourly rated grease wool capacity of 3,200 pounds and can be efficiently utilized only in relatively large scouring operations, much larger than most beginning plant operators should anticipate. 6/

6/ Information on equipment furnished primarily by James Hunter Machine Co., North Adams, Mass.

Scouring trains may have as few as 4 bowls or as many as 7. A 5-bowl train was recommended for commission scourers, with a sixth stainless steel bowl if considerable bleaching is anticipated. Using too few bowls necessitates increasing the liquor temperature and cleaning ingredients, and working the wool too fast. This tends to felt the wool, increasing the manufacturing cost and lowering the value of the products. The same result may occur if a train is forced very far beyond its rated capacity. Although the newer trains with direct motor drives instead of belts can scour much larger quantities of wool than their rated capacity, it is detrimental to the wool--a risk that commission wool scourers can ill-afford to take.

The cost of a new 60-inch-wide, 5-bowl scouring train with feeder, opener, drier, and supporting equipment is about $125,000, f.o.b. Massachusetts shipping point (table 23). Assuming a 20-year life and straight-line depreciation, the depreciation cost of the production equipment would be approximately $6,270. Used scouring equipment is currently rather scarce and limited to 48-inch-wide bowls of questionable future productivity.

The cost of a wool baler varies considerably. A leading textile machinery company suggested a double-box baler similar to the standard cotton baler. With supporting motors and hydraulic system, this type of baler will cost about

Table 23.--Description and cost of selected pieces of wool scouring equipment

Item	Number	Cost 1/
60" floor feed (width 8' extension or a deep pit type)	1	$ 4,565
2-cylinder, 60"-wide wool opener complete with motor drive	1	7,175
60" floor feed with screened enclosure for the hopper	1	2,665
60" x 24' desuinting bowl with 2-gear motor drives	1	16,460
60" x 32' scouring bowl with 2-gear motor drives	1	18,505
60" x 24' scouring bowl with 2-gear motor drives	1	16,285
60" x 16' rinse bowls with 2-gear motor drives	2	28,130
6-section, 3-apron stock drier complete with 2"-indicating-type temperature control and a collecting hopper	1	26,885
Condenser, blowers, and filter to handle stock from drier to baler and return of filtered air	1	4,730
Total	10	$125,400

1/ F.o.b. Massachusetts shipping point.

$13,750, f.o.b. South Carolina shipping point. Estimating the baler's life at 10 years, the annual depreciation would be $1,375. Most scouring plants, however, were using single-chamber balers costing from $2,500 to $5,600. These figures do not include transportation or installation.

Grease recovery systems are nearly essential to commercial scouring systems because of State and Federal water pollution laws. The amount of wool scouring waste is not large compared to the waste from other industries, but it is one of the most undesirable as it contains large amounts of highly putrescible organic matter (23). Wool grease is recovered by 2 methods in the United States--1 a mechanical process using a centrifuge, and the other, a chemical process. In the latter, the scouring emulsion is cracked or broken by adding sulphuric acid and the grease and sludge settled out and separated by filtering under heat and pressure. The centrifuge system, which is the less expensive, operates on the same principle as a cream separator. In addition to separating the grease and water it also removes the suspended solids as a sludge (23).

Two companies in the United States supply all of the centrifugal grease recovery equipment. A minimum installation consists of a heating unit, a cooler, a settling tank, a reserve tank, and a centrifuge. The cost of a new complete system, f.o.b. shipping point, is about $42,500. Assuming a useful life of 10 years on most of the components, the annual depreciation would be $4,250. Lease arrangements are possible on part of the equipment. The cost and availability of used grease recovery systems is not known.

The installation cost of all this equipment can only be approximated. Such items as labor, wire, pipe, sheet metal, and other materials would probably be purchased locally. But, in general, the installation cost will approximate 10 percent of the cost of the equipment. The cost (new) of the 5-bowl scouring train and supporting equipment (table 23), a double box baler, and a grease recovery system would be about $181,600. Installation cost would be another $18,000; a total of about $200,000.

The shipping weight of all this equipment is about 230,000 pounds. The transportation cost for moving this equipment from Massachusetts to a point like Denver, Colo., would be about $5,100. 7/

A forklift for handling bales, a couple of handtrucks, grading and sorting tables and baskets, office equipment, and laboratory equipment would probably cost another $15,000 depending upon the availability and location of used items. A reasonable annual depreciation figure might be $1,500.

Thus, total equipment cost including transportation and installation is estimated at $220,000 with an annual depreciation of about $13,400.

Buildings.--Manufacturers of scouring equipment suggest that the feeder, train, drier, and baler be placed in a straight line within the plant. Such an arrangement allows one to scour wool with a minimum of equipment. The floor space requirement of a single-train scouring building is approximately 30 x 250 feet or 7,500 square feet. An increase of 50 feet in width is suggested for each additional train (23).

7/ Information furnished by Traffic Management Branch, Agr. Stab. and Conserv. Serv., U.S. Dept. Agr.

A wool warehouse handling approximately 10 million pounds of grease wool per year requires at least 25,000 square feet. This assumes that the flow of grease wool through the warehouse will be fairly uniform throughout the year and that the wool can be stacked 14 or 15 feet high within the warehouse. Scoured-wool storage space would be extra.

Thus a minimum of 32,500 square feet of space is needed. The General Services Administration, which obtains space for the Government, estimates that suitable buildings in good condition--with a heavy-duty floor, heat, water, electricity, and good transportation facilities--can probably be leased in the larger Western cities for about $1 per square foot. This would be a total of $31,250 annually. Similar structures in Eastern cities cost $1.25 per square foot.

The lease arrangement eliminates heavy initial cash expenditures for land and for designing and building facilities. The cost of land and of building a structure for wool scouring and storage varies so widely, depending upon the location and construction material, that an estimate of cost would have little significance.

Labor.--Annual labor costs of nearly $124,000 are estimated on the basis of 20 men on the first shift and 16 on the second, 5 days a week, 50 weeks a year. The duties of many employees are varied but an attempt is made to indicate the major work areas (table 24). Also, the wage rates in any particular area may differ considerably from those indicated. But the average rate of $1.59 per hour is only 5 cents below the national average straight-time earnings of production and related workers in the scouring and combing industry (37) The wage differential for the second-shift employees (when any wage distinction is made) is only 4 cents per hour and was not considered in estimating labor cost.

Repairs and supplies.--Maintenance and repair, including parts, are estimated at $2,500 annually. Scouring detergents and laboratory chemicals are estimated at $25,000 annually. Both of these figures may vary widely. Most plants now use a synthetic detergent instead of soap and soda ash for scouring. The detergent requirement, assuming a grease recovery unit is utilized, will average about 0.6 percent of the weight of the grease wool scoured. Office supplies will probably add another $500 per year.

Water.--The water requirement to initially charge all 5 bowls is 14,500 gallons. By running 2 shifts a day and utilizing a grease recovery system, dumping the entire train can probably be limited to once a week. The first bowl becomes dirty very quickly during operation and an equipment manufacturer suggests 3 to 4 inches of the water be let out every hour or so by cracking its sumps, and that the first bowl be completely dumped after the second shift. Also bowl temperatures should be maintained during the nonoperative third shift to reduce the risk of putrifaction in the scouring liquors.

During operation, the scouring equipment will require an additional 1,800 to 2,000 gallons of water per hour. Assuming the plant operates 2 shifts a day, 5 days a week for 50 weeks, the total annual water requirement will be nearly 8.5 million gallons. Applying rates of a large Western city (4) where water is relatively plentiful, the annual water costs would be slightly more than $1,400. In other Western cities, water costs might be as high as $2,500.

Table 24.--Personnel requirements and labor costs, by duty, for a model plant scouring 10 million pounds of grease wool annually

Duty	Hourly rate	Personnel requirements		Annual cost 1/
		First shift	Second shift	
	Dollars	Number	Number	Dollars
Receiving wool at warehouse	1.25	1	0	2,600
Grader	2.25	1	1	9,360
Warehouse crew	1.25	4	4	20,800
Feeders of train	1.50	2	2	12,480
Train and drier operator	2.50	1	1	10,400
Baling crew	1.25	2	2	10,400
Handyman	1.25	1	1	5,200
Mechanic	2.75	1	0	5,720
Pickers	1.25	4	4	20,800
Supervisor	3.00	1	1	12,480
Bookkeeper-secretary	1.75	1	0	3,640
Plant manager	2/	1	0	10,000
Total or average	3/ 1.59	20	16	123,880

1/ Includes wages and 2-week paid vacation. No allowance for Social Security, medical programs, bonuses, etc.
2/ Salaried.
3/ Weighted average hourly rate excluding plant manager.

Steam.--Steam is used to heat the scouring bowls, the drier, and the grease recovery unit. An equipment manufacturer estimates that these will require about 50,000 pounds of steam per hour. The extra steam required to heat the bowls initially is offset because no wool is being scoured at that time and the drier and grease recovery unit are not operating. Based upon the rate of a large Western city (20) the annual steam cost would be about $15,300.

Electricity.--The scouring train and supporting equipment has a connected horsepower of about 150. This equipment will demand some 130 kilowatts and, operating two shifts, will consume about 45,000 kilowatt-hours monthly. Considering the additional electrical requirements for lighting office and laboratory equipment, and incidentals, the annual electricity costs are estimated on the basis of 150 kilowatts monthly billing demand and 60,000 kilowatt-hours monthly consumption. On this basis, annual electricity costs would be as low as $6,876 in Portland, Oreg.; and as high as $11,736 in locations like San Angelo, Tex. (5). An average annual cost of $9,500 is assumed in estimating the cost of scouring wool in the West.

Miscellaneous.--The operators of scouring plants in the West estimated miscellaneous expenses at about $13,000 annually. This category includes payroll taxes, advertising, travel, legal and accounting fees, and dues, subscriptions, and donations.

Total.--Summarizing the physical input and cost data developed above, the estimated average cost per 100 pounds of grease wool for a commission scourer to process 10 million pounds of wool annually is $2.36 (table 25). This includes no allowances for local, State, or Federal taxes except Social Security. Costs will differ among locations. Operators in the New England area, for example, probably have significantly higher labor costs than those estimated. But this average figure is in close agreement with cost data obtained from plant operators in the West.

VII. TRANSPORTATION REGULATIONS AND RATE STRUCTURES FOR WOOL

Transportation to manufacturing centers is one of the major cost items in marketing raw wool. Transportation regulations and rates for wool are complicated and are modified frequently with the result that expected savings in transportation cost by scouring wool in the West may be more fancied than real. Savings, if any, depend largely upon the location of the scouring plant in relation to the wool to be scoured and the mill which will use the wool.

The classification of wool by the Interstate Commerce Commission as an "exempt" commodity is quite important to some locations. Transit privileges also cause substantial variations in the cost of transporting wool under what appears to be quite similar distances and circumstances. Thus, categorical statements cannot be made about savings in transportation cost due to scouring in the West.

Table 25.--Estimated average cost per 100 pounds of grease wool for a commission scourer to process 10 million pounds of grease wool annually, by items, United States

Item	Cost
	Dollars
Depreciation on equipment	0.1340
Rent	0.3125
Labor	1.2400
Repairs and maintenance	0.0250
Supplies and material	0.2550
Water	0.0140
Steam	0.1530
Electricity	0.0950
Miscellaneous	0.1300
Total	2.3585

To evaluate selected alternative plant locations one must determine their comparative transportation advantages. But the determination and analysis of current rates at selected locations is expensive, time consuming, and of limited use to others. Certain point-to-point rates applicable to the movement of a given minimum weight of wool from specific points of origin to a given destination may be obtained from the published tariffs of the major regulated carriers. However, rates have not been published from innumerable locations which one might consider as potential wool scouring plant sites. Also, point-to-point rates are constantly changing as higher weight minimums are authorized and transit privileges are modified. Therefore, the development of an adequate method to predict rates for comparative purposes became a major objective of this study.

Rate structures for rail and motor carriers may vary with value of services, weight and density of the commodiy, "cost" of transportation, and other factors in addition to the distance involved. To determine the effects of each of the factors on rates and include them in an estimating equation would be too complicated and cumbersome. We are not concerned with predicting changes in level of transportation rates, but with predicting variations in rates among different locations regardless of the level of rates. The Interstate Commerce Commission's long-standing policy of nondiscrimination among shippers within the same area makes this feasible. The relatively low level of rates recently approved for Southwestern Territory rail shipments is somewhat of an exception to the policy of nondiscrimination, but rates within the area are identical.

Although most freight rates incorporate factors other than distance, the structure of the "class rate" is based primarily upon the rail shortline distance scale. While specific commodity rates are published for wool, the ICC, in settling many wool rate cases, used the class rate structure as a guide. The result is that the charges for wool transportation have evolved to the distance-scale principle of ratemaking. Thus, it was decided to test the predictive value of just this one variable--distance.

To compare the transportation advantages of different locations for the scouring of wool, 3 types of rates need to be determined or estimated. First, the through rate, or the cost of shipping the grease wool from the local production or marketing point direct to the mills. Second, the combination rate, which describes the costs of shipping grease wool from the local production or marketing point to an intermediate point for scouring and the costs of shipping the scoured wool on to the mill. Third, one should evaluate the effect of scouring intransit privileges which carriers may grant, and the accompanying transit rate. The basis for the development of equations to estimate these rates and the limitations involved in using them will be discussed.

But first, a highly significant rail rate development of late 1963 should be noted and its relation to this analysis clarified. In October 1963, some of the Southern rail carriers requested and were granted by the ICC a somewhat revolutionary rail ratemaking method for shipments originating within the Southwestern Territory and destined for the Southern Freight Territory (fig. 15). 8/

8/ Application X-A-48-22, Southwestern Freight Bureau, St. Louis, Mo., Aug. 5, 1963.

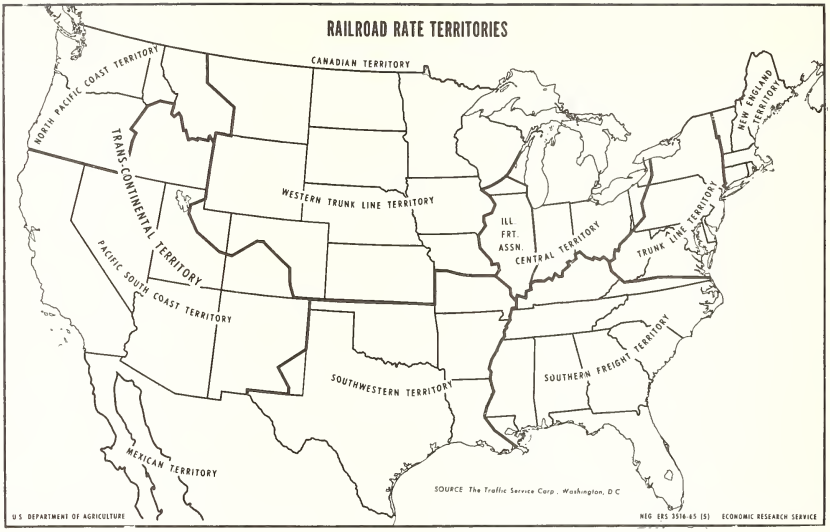

Figure 15

The rail rate schedules authorized on wool and mohair shipments originating in the Southwestern Territory and destined for the Southern Territory are based solely upon costs of transportation and distance. These resultant rates are considerably lower than the previous rates and than those still authorized for origin points of similar distance. In November 1963, the destination points were expanded to include the Official Rate Territory (Illinois Freight Association, Central Territory, Truck Line Territory, and the New England Territory) (fig. 15). 9/

Western Trunk Line (fig. 15) carriers discussed but decided against requesting a similar ratemaking method and schedule of rates for wool shipments originating within their area at a meeting in January 1964. In March 1964, another WTL proposal was docketed 10/ on the same principle which these carriers have now declined. 11/ It may be presumed that this decision is final for some time to come. 12/ Motor carriers are not nearly as serious competitors of rail carriers for wool shipments in the WTL Territory as they are in the Southwest and the same incentive to reduce rates is lacking.

9/ Application X-A-48-23, Southwestern Freight Bureau, St. Louis, Mo., August 5, 1963.

10/ Application 48-448, Western Trunk Lines, Chicago, Ill., Mar. 5, 1964 as supplement Apr. 1964.

11/ Correspondence from J. R. Walter, Freight Bureau Manager, Atchison, Topeka, and Santa Fe Railway Co. to E. F. Heitz, Agr. Mktg. Serv., U.S. Dept. Agr.

12/ Transportation Services Branch, Agr. Mkt. Serv., U.S. Dept. of Agr.

A similar situation exists in the far West for the Transcontinental carriers (fig. 15). Rail carriers still handle the bulk of the wool moved out of the region. In August 1964 the Transcontinental railroads had before them a proposal 13/ to establish the Southwestern rate level but had not acted on it. However in early 1965, a California trucking firm reportedly initiated the Texas System of baling, utilizing a portable baler. This development may cause the railroads to further evaluate their position.

Through Rates and Combination Rates for Grease and Scoured Wool

The adoption of a published mileage rate by Southwestern rail carriers greatly similifies the problem of estimating through rates for scoured and grease wool from the Southwestern Rate Territory to most points east of the Mississippi River. But we still need some estimate of combination rates and a method of estimating all transportation rates relating to shipments originating outside the 5-State Southwestern Rate Territory.

Development of Rate Differential Equations for Rail and Motor Carriers

To test the accuracy of predicting through rates for shipments originating outside the Southwestern Territory using just distance as a variable, the relationship between the distance wool moved and the existing rates per hundredweight applicable to the movement were determined. This relationship was measured by correlation analysis for groups of randomly selected point-to-point rail and motor carrier rates in the published tariffs and the rail and motor carrier shortline miles between the specific points. 14/ Four minimum rail weights for grease wool were analyzed along with 2 minimums for scoured wool. Motor carrier tariffs do not distinguish between grease and scoured wool for ratemaking purposes so the 3 minimums analyzed will apply in either case (table 26).

13/ Application C-15448, Transcontinental Freight Bureau, Chicago, Ill., Apr. 16, 1964, as supplemented May 20, 1964.

14/ Domestic grease or scoured wool may be hauled by any motor carrier without regard to published rates if, on that particular movement, the carrier is transporting only exempt commodities. This exception is provided for in Part II of the Interstate Commerce Act, section 203 (b) (6), as amended. Exempted are those motor vehicles used in carrying property consisting of ordinary livestock, fish, or agricultural commodities (not including manufactured products thereof), if such motor vehicles are not used in carrying any other property or passengers for compensation. If a motor carrier splits a load between exempt and nonexempt commodities the published tariff must then be followed on all items and the value of the exemption is lost. For those movements on which the motor carrier qualifies under the exemption, the exempt rate is generally negotiated between the shipper and the carrier rather than quoted from a published rate. Hence, an accurate point-to-point exempt rate schedule is difficult to develop though it would be somewhat lower than the published rates. The published motor carrier rates used in the comparative analysis should then be considered a maximum truck rate and may be used as a guide for negotiating exempt rates for specific wool movements.

Table 26.--Measures of relationships between distance wool is hauled and transportation rates, by type of carrier, condition of wool, and minimum load weight, United States, 1960 1/

Type of carrier and condition of wool	Minimum load weight	Tariff observations: Sample	Tariff observations: Proportion of total tariffs	Correlation analysis: Correlation coefficient (r)	Correlation analysis: Coefficient of determination (r^2)	Regression analysis: Y Intercept (a)	Regression analysis: Regression coefficient (b)	Regression analysis: Standard error of estimate (Sxy)
	Pounds	Number	Percent		Percent	Cents/cwt.	Cents/cwt.	Cents/cwt.
Rail:								
Grease	24,000	263	45	0.965	93.2	92.14	0.13559	8.4
do	30,000	263	45	.948	89.9	67.33	.08792	7.1
do	40,000	263	45	.946	89.6	65.07	.07847	6.5
do	60,000	263	45	.966	93.1	62.14	.07166	4.4
Scoured	28,000	71	25	.871	75.8	118.00	.04088	3.0
do	30,000	71	25	.928	86.1	89.56	.08062	5.7
Motor:								
Grease or scoured	7,000	64	40	.916	83.9	49.05	.16648	10.3
do	14,000	22	100	.917	84.0	35.46	.12089	7.4
do	24,000	47	60	.980	96.1	33.27	.09915	9.1

1/ Rail rates taken from: Transcontinental Freight Bureau, freight tariff 33-J, ICC, 1621, item no. 600-6030, effective Dec. 21, 1959, and Western Trunk Lines freight tariff 172-H.

Motor rates taken from: Pacific Inland Tariff Bureau, Inc., agent, tariff no. 8-C, MF-ICC No. 85, item no. 4700-6770. Rocky Mountain Motor Tariff Bureau, Inc., agent, commodity tariff no. 7-G, MF-ICC No. 110, item no. 25-9920, effective Aug. 30, 1958. Southwestern Motor Freight Bureau, Inc., tariff no. 7-K, effective Sept. 3, 1958.

The random sample of 1,194 rates indicated that the highest published rail rates pertained to movements of 2,300 miles or more, destined for the New England area. The highest published rail rates to the Middle Atlantic States applied to movements of 2,120 miles or more and those to the Southeast applied to mileages of 2,050 or more, regardless of origin points. Rail movements in excess of these mileages moved at these "break-point" rates. The largest single motor carrier rate applied to shipments of 2,500 miles. Thus, when rates for distances greater than these are computed, only the appropriate break-point mileage in the prediction equation should be employed.

The correlation analysis indicates that a close association exists between distance and published rates for both rail and motor carriers. A correlation coefficient (r) of 1.0 expresses a perfect relationship and those obtained in this analysis ranged from 0.87 for 28,000-pound rail shipments of scoured wool to 0.98 for 24,000-pound motor carrier movements (table 26). The coefficients of determination (r^2) computed for each sample group indicate that variation in distance alone explain from 83 to 96 percent of the variations in rates (table 26).

With the closeness of association between distance and rates established, the prediction equation was developed utilizing linear regression analysis making distance the only independent variable. The general equation, $y = a + bx$, which describes a straight line, was tested and its accuracy established (table 26). In general, transportation rates do not vary proportionally with distance, but rather, they tend to increase at a decreasing rate as the distance becomes greater. This suggests that a curvilinear regression analysis might result in even smaller standard errors of estimate for each group. However, the linear equation is thought to be more satisfactory for our purpose due to its relative simplicity and the smallness of the error terms--ranging from 3 to 10 cents per hundredweight. Establishment of the linear relationship for both grease and scoured wool and for either type of carrier allows one to also use the same equation ($y = a + bx$) for computing combination rates.

There are 3 rate estimating methods for shipments originating within the Southwestern Rate Territory. Selection depends upon the destination of the wool or mohair shipments. Rates for shipments to the Southern Rate Territory may be estimated by utilizing the published rate schedule (appendix B) with a 30,000-pound minimum weight. For shipments to the Official Rate Territory the same published rate schedule (appendix B), but in conjunction with a 40,000-pound minimum, should be used. For shipments to the Transcontinental, Western Trunk Line, or within the Southwestern Rate Territory, the estimating equation developed below should be utilized. One exception should be noted. For these particular rate authorizations, eastern New Mexico, which is actually in the Transcontinental Territory, has been classified in the Southwestern Rate Territory by the ICC.

Application of the Differential Equations

Let us assume that Denver, Colo., is being considered as the location for a new wool scouring plant. Assume further that scouring cost and the supply of wool in the immediate area have been evaluated along with competition from existing local scouring plants. The feasibility of locating a plant in Denver may hinge entirely on the success of the proposed plant in soliciting wools

concentrated in wool marketing centers outside of Colorado. One such marketing center is Belle Fourche, S. Dak.

Wool flow data, presented previously in the report indicates that over 7 million pounds of grease wool move out of South Dakota in bales and that most of it moves by motor carriers, primarily to the Southeast. An estimate is needed of the transportation savings obtainable from scouring these wools in Denver instead of their being sent direct to the Southeast for scouring and processing.

Application of the differential equation, $y = a + bx$--where (a) is the base rate and (b) the rate coefficient for the specific mode of transportation and specific minimum weight, and (x) is the distance the commodity is moved--will provide an estimate of the through rate. To determine input information for movements by motor carriers from Belle Fourche, S. Dak., to say Norfolk, Va., at the 24,000 pound minimum, see table 26. Here it is indicated that the base rate (a) or the rate to be expected if the distance is zero, has a value of 33.27 cents per hundredweight. The corresponding rate coefficient (b) is 0.09915. A highway atlas gives the short-line highway mileage between Belle Fourche and Norfolk at 1,836 miles. The differential equation, where y is the calculated through rate, then reads: $y = 33.27 + 0.09915\ (1,836)$. Solving the equation yields a y value of 215 or $2.15 per hundredweight. This is the estimated through rate. The standard error of 9.1 (table 26) indicated that the computed rate probably is accurate within plus or minus 9.1 cents per hundredweight. The product of the rate $\pm$ times the volume to be shipped (24,000 pounds) gives a total charge of \$516.00 $\pm$ \$21.84.

Next, information is needed on the combination rate. This involves computing the rates and costs of shipping the grease wool from Belle Fourche, S. Dak., to Denver, Colo., and the resultant weight of scoured wool from Denver to Norfolk, Va. The inbound rate to Denver is calculated in the same manner as the previously estimated through rate. In this instance, $y = 33.27 + 0.09915\ (456)$, where 456 represents the short-line highway mileage between the two points. Solving the equation yields an inbound rate of 78.48 cents $\pm$ 9.1 cents per hundredweight and the total inbound cost is estimated at \$188.35 $\pm$ \$21.84.

The outbound rate of Norfolk and total charge for the scoured wool shipment may need to be estimated under a different set of conditions. Some estimate must be made of the scoured wool content of the original 24,000-pound grease wool shipment. Assuming that wools produced and concentrated in the Belle Fourche area shrink 53.2 percent (or conversely, yield 46.8 percent), the original grease wool shipment will yield about 11,232 pounds of scoured wool. If, for some reason, other wools are not combined with this lot on the outbound movement, the 7,000 pound minimum would apply with an (a) of 49.05 and (b) of 0.16648 (table 26). Y, (the outbound rate in this instance) then would equal $49.05 + 0.16648\ (1,778)$ where 1,778 is the short-line highway miles between Denver, Colo. and Norfolk, Va. Solving the equation yields a rate of 345.00 cents $\pm$ 10.3 cents per hundredweight. Multiplying this outbound rate by the 11,232 pounds of scoured wool gives a total estimated outbound charge of \$387.50 $\pm$ \$11.57. Combining the inbound charges (\$188.35) and the outbound charge (\$387.50) gives a total inbound-outbound charge of \$575.85. A loss of \$59.85 compared to a through shipment of the grease wool.

An efficient operator, however, would ship a part-load only under the most unusual circumstances. The normal policy is to accumulate scoured wools until the weight minimum for the most feasible rate has been reached. Assuming the 11,232 pounds of scoured wool in this example were shipped out of Denver as part of a load of 24,000 or more pounds, the outbound charge would be only $236. A total savings over the charge for a through shipment of $91.65. The total inbound and outbound charge of $424.35 divided by the original 24,000 pounds gives a grease wool equivalent rate of $1.77 per hundredweight.

An alternative method, utilizing a "material index" may facilitate the computation of combination rates and charges. The foregoing method by which the combined inbound-outbound charge was determined is admittedly long and laborious, but was used to show the basis of combination rates and charges. The same data will be used to illustrate the alternative method and compare it with the previous method. The inbound-rate equation is applied as before; however, the estimated rate derived from the inbound equation is added to the rate derived from the appropriate outbound equation, divided by the material index for the wools produced in a particular area.

The material index may be thought of as a grease weight of the wool divided by its estimated clean or scoured weight. In the previous example, the yield of South Dakota wools was estimated at 46.8 percent so that material index would be 1/.468 = 2.1.

The equation to compute a combination rate then, using the same data as before will read:

$$C = 33.27 + 0.09915\ (456) + \frac{33.27 + 0.09915}{2.1}\ (1{,}778)$$

$$= 78 + 100 = 178 \text{ cents per hundredweight.}$$

Application of this rate to the 24,000-pound shipment results in an estimated total transportation charge of $427. The slight difference between this figure and the one computed by the previous method ($424.35) is due to rounding of numbers.

Application of the rate schedule for rail shipments originating in the Southwestern Rate Territory (appendix B) is fairly direct, except for the incentive-loading or discount-rate provision. The schedule provides for approximately a one-third decrease in the applicable rate for all tonnage in excess of the specified minimum weight.

For example, consider San Angelo, Tex. as a scouring plant site and estimate the possible savings for wools now marketed in Albuquerque, N. Mex., and shipped unscoured by rail to the Southeastern States. The short-line distance from Albuquerque, N. Mex., to Norfolk, Va., is 2,059 miles. For distances between 2,051 and 2,075 miles, the grease wool rate on the first 30,000 pounds (the destination being the Southern Freight Territory) is 1.57 cent per pound and 1.06 cent for that loaded in the same car in excess of 30,000 pounds. Assuming a 60,000-pound shipment, the estimated cost would be 30,000 times 1.57 cent ($471), plus 30,000 times 1.06 cent ($318), a total of $789; an average rate of 1.32 cent per pound.

If a 60,000-pound car of Albuquerque, N. Mex., grease wool were scoured in San Angelo, Tex., and the scoured wool shipped to Norfolk, Va., one needs to use both the grease and scoured wool rates. The rail short-line miles from Albuquerque to San Angelo is 567 miles. The applicable rate on the first 30,000 pounds is 0.71 cent per pound and 0.475 cent per pound for the other 30,000 pounds. A total inbound charge of $355.50.

Assuming that the Albuquerque wools yield 35.5 percent, the 60,000-pound inbound lot will result in a 21,300-pound outbound lot which, if shipped by itself, would go as 30,000 pounds, or the minimum load rate. The rail short-line distance from San Angelo to Norfolk is 1,670 miles and the scoured wool rate on the first 30,000 pounds is 1.51 cent per pound (appendix B), a total outbound cost of $453. Thus, under these conditions, the total transportation charge for routing these wools through San Angelo for scouring would be $355.50 plus $453, or $808.50; $19.50 more than the through shipment of grease wool.

If the 21,300 pounds of scoured wool were combined with other scoured wools for shipments, as would usually be the case, and the total lot weighed 40,000 pounds, the total outbound cost, utilizing the discount rate of 1.01 cent for the 10,000 pounds in excess of the minimum, would be $554. The proportionate share of the total charge for the 21,300 pounds of wool would be $295.05 instead of $453 if shipped alone. Under these conditions, a savings of nearly $140 would result by scouring the wool in San Angelo.

The estimating-rate equations (table 26) may be combined with the published rail rates (appendix B) to compute transportation costs of shipments which originate outside the Southwest Rate Territory but are scoured within it, and the scoured wool then shipped to the East Coast.

Utilizing the differential equations presented and the published rates for selected rail shipments along with the information developed below relating to transit privileges and rates, one can evaluate the savings which scouring at any particular point might effect, depending upon the yield of the wool, the origin and destination points of the shipments, the types of carriers, and various weight minimums. The relative transportation advantages of competing scouring plants may also be estimated by the same procedure. The differential equations presented here and the information relating to transit privileges, are employed in section VIII for estimating the transportation differentials of 7 western and 3 midwestern cities selected as example sites for wool scouring plants.

A word of caution is warranted relating to the transportation rates of motor carriers. Although the truck rates used in testing the predictive equation are applicable to the movement of wool according to the published tariffs of the regulated carriers, which are on file with the ICC, they are not necessarily the rate at which all wool transported by motor carriers is shipped. This is because grease and scoured wool come under the agricultural exemption (see footnote 14, page 75).

Rail Transit Privileges for Scouring

The granting of transit privileges by a carrier may alter any previous evaluation of plant sites because these privileges tend to greatly diminish the

importance of transportation as a locational factor. A method to estimate the effect of rail transit privileges on wool transportation rates was developed and is employed in example transportation evaluations of 7 western and 3 midwestern cities as possible wool scouring plant sites (section VIII). An explanation of the purpose and characteristics of transit privileges is presented along with a discussion of how to estimate their effect.

Purpose and Characteristics

It is an old transportation adage that "a single through rate between 2 given points is usually less than a combination of 2 or more local rates between the same points, other things remaining the same." Also, in the absence of overriding limitations, a single through rate tends to cause a concentration of industry either at the raw material source or at the market area, rather than at some point in between. The above discussion of combination rates indicates that scouring wools from certain areas at an intermediate point might reduce transportation charges (not rates), but this was true only to the extent that the decrease in weight more than offset the increase in rates. This is not the case with transit privileges.

A transit privilege is an agreement between the carrier and the shipper to allow the stopping of a shipment for processing and the subsequent reshipping of the processed commodity at a rate equal to or less than the through rate. This arrangement was first used by railroads as a device to afford to certain shippers and localities preferences which took the form of personal discrimination through rebates, departures from published rates, variation in service, and commodity discrimination through unequal freight charges for like products (6). With the creation of the Interstate Commerce Commission, came regulations which prohibited carriers from continuing the more obvious forms of preferences to favored shippers and localities. The ICC is reluctant to encourage the extension of transit privileges and is inclined to criticize the carriers for being unduly liberal in granting them, particularly when they result in backhaul or out-of-line hauls which result in economic waste (16). The Commission has rarely required the establishment of transit privileges and then only to prevent unjust discrimination, undue preference, or prejudice.

The transit rate may still take varied forms but its main purpose is to secure a greater volume of traffic for the carrier granting the rate by decreasing total transportation charges to the shipper. Railroads have granted these privileges to encourage the industrial development of right-of-way by those industries requiring large-volume movements. In most intransit processing privileges there are certain routing restrictions placed upon both the inbound and outbound movements of the commodity to be processed which provide the authorizing carrier the greatest possible length of haul.

Transit privileges were first applied only to a small list of commodities such as lumber, cotton, and grain, but it is now estimated that some 300 commodities meet the requirements for some form of transit rate (16). The generally accepted form of transit rates may be summarized as follows: (1) If inbound and outbound rates on the commodity moving to the transit point are not equal, the higher rate will apply as the base transit rate; (2) the full rate from point of origin to point of transit is applicable to the movement inbound for transit;

however, when the processed goods move out of the transit point, the applicable rate is the balance of the through rate in effect from the original shipping point to final destination; (3) although the identity of each shipment is not preserved, records of each movement regarding billing and tonnage must be maintained for through-rate computation; (4) the outbound tonnage applicable to the balance of the through rate is usually less than the inbound tonnage to the transit point due to the weight-loss characteristic of most processing operations (16). An example of the type of transit privilege that may be authorized for a wool scouring plant located in the producing area is presented in appendix C.

Weight loss in processing is a prime consideration when transit privileges are included in estimating transportation cost. As most transit privileges are based on "inbound rates and outbound weights," then the greater the weight loss in processing, the more beneficial may be the application of transit rates. Even the transit charge affixed to transit movements by carriers for extra handling and switching does not increase total transportation costs to a point in excess of the total costs for through shipments.

Thus, with transit privileges, the importance of transportation as a locational factor is diminished. Transit privileges provide for the adjustment of freight rates to the extent that intermediate points have an equal or even greater advantage as processing sites than was shown in the previous analysis where only distance and weight-loss factors were involved. Transit privileges, or the lack of them, are so important to the evaluation of scouring plant sites that a method of predicting transit rates for comparative purposes is presented.

The Development and Application of a Transit Rate Differential Equation

An equation to predict transit rates for comparative purposes was developed, utilizing those transit privileges presently authorized for wool scouring plants. The estimating rate equation, rate error, and material index developed earlier in this section for computing the estimated through rates and combination rates are also employed to estimate transit rates.

The general formula for estimating the transit rate is:

$$Tr = Ir + \frac{\text{highest rate} - Ir}{MI} + Tc$$

Where: Tr = transit rate
Ir = inbound rate
Tc = transit charge
MI = material index

To employ this formula, first compute the appropriate inbound rate, outbound rate, and through rate, utilizing the methods developed above. Then subtract the inbound rate from the highest of these rates, divide this difference by the material index, also developed above, and add the resultant figure to the inbound rate and the transit charge. The transit charge for the extra handling and switching is negotiated between a carrier and a shipper. Observed charges ranged from 7 to 9 cents per hundredweight and the latter figure is used in computing transit charges in this report.

To estimate the rail transit rate and total transportation charge for a 60,000-pound lot of grease wool in Salt Lake City, Utah, to be scoured in San Angelo, Tex., and then reshipped to Boston, the full inbound rate to the San Angelo plant is initially applied to the shipment. This rate is estimated, as described previously, by the following equation. Inbound rate = base rate plus the rate coefficient times the rail short-line mileage from Salt Lake City, Utah, to San Angelo, Tex., which is equal to: $62.14 + 0.07166\ (1,265) = 152.79 \pm 5.7$ cents per hundredweight. Applying this rate to the 60,000-pound movement results in an estimated total inbound charge of $916.74 \pm $34.20. The transit charge for the extra handling and switching is assumed to be 9 cents per hundredweight or a cost on this 60,000-pound shipment of an additional $54.

The outbound rate for scoured wool from San Angelo, Tex. to Boston (2,063 miles) for a 40,000-pound car is 177 cents per hundredweight (appendix B). If the scouring plants were not located within the Southwestern Rate Territory, the outbound rate would be estimated using the equations in table 26, p. 76.

The through rate from Salt Lake City to Boston is similarly estimated to be $62.14 + 0.07166\ (2,300) = 226.96 \pm 4.4$ cents per hundredweight. The actual short-line rail mileage is 2,462 but the 2,300 "breakpoint" is the maximum mileage applicable to New England destination points.

The through rate is the highest of the 3 so the transit rate equation is:

$$Tr = 153 + \frac{227 - 153}{2.5} + 9$$

$$= 192 \text{ cents per hundredweight.}$$

A comparative analysis of transit rates with through and combination rates for the various origin and destination points should indicate, from the standpoint of transportation cost, which producing areas may be most economically serviced by a scouring plant located in the San Angelo, Tex., area.

The estimated rates used in this analysis or calculated by the methods developed, are only for comparative analysis. The rate-estimating equations will provide a basis for eliminating many "possible" scouring plant sites and will give the expected "trade area" of selected sites. Actual point-to-point rates and authorized transit rates should be analyzed prior to a final decision on the suitability of any site as a wool scouring plant location from the standpoint of transportation cost. The differentials computed by the method developed here could then be employed to fill in any missing rate data.

VIII. A TRANSPORTATION AND SUPPLY EVALUATION OF SELECTED WESTERN WOOL SCOURING SITES

Point-to-point evaluations have been stressed throughout this report though much of the information presented so far is in general terms--trends in supply and mill locations, transportation precedents, and the rate structure and type of operation. This section provides some examples of how to utilize this information to evaluate a specific location for a wool scouring plant. Nine cities scattered throughout the West were selected for evaluation, although other sites

could have been selected. These cities are merely examples. In addition to estimating the supply of wool for which a particular location has distinct transportation advantages, consideration also should be given such factors as the water supply and cost, the labor supply and cost, and local tax rates.

The Selection of Sites for Evaluation

To facilitate analysis of the influence of transportation and wool production in "the feasibility of wool scouring in the West," the 11 Western States and the major wool producing regions of Texas were divided into wool transportation-production areas. Nine "raw material" areas were selected for evaluation. The delineation of these areas was based upon the transportation and wool production data presented previously. Information on motor- and rail-freight services available at various points within each area and the wool concentration patterns (13) were used as a basis for selecting a specific city within each area for study. The selected cities are: Albuquerque, N. Mex.; Belle Fourche, S. Dak. Butte, Mont.; Denver, Colo.; Needles, Calif.; Portland, Oreg.; San Angelo, Tex.; Salt Lake City, Utah; and Stockton, Calif., (fig. 16).

Except for Needles, Calif., and to a less extent Butte, Mont., these cities qualify both as transportation and wool concentration centers. Few sheep are produced and there are no known wool warehouses in the southern California, western Arizona area represented by Needles. The majority of this area's wool production can probably be attributed to the shearing of feeder lambs primarily in and around Blythe, Calif.

The Belle Fourche-Newell area of South Dakota, while slightly outside the 11 Western States, was selected for evaluation due primarily to its importance as a wool concentration and marketing center. Large volumes of wool produced in the adjacent Western States of Wyoming and Montana, in addition to wools produced in North and South Dakota, are marketed through warehouses in the area (13). For this reason, the volume of wool produced in North and South Dakota is considered in evaluating the community as a potential scouring plant site, even though information relating to its grade and staple is not currently available.

The Selection of Wool Consumption Centers

The delineation of our wool transportation-wool concentration areas and selection of a representative city for each solves only part of our analytical framework. Specific cities in the mill or wool consumption area must also be selected to make point-to-point comparisons. The wool processing industry, the scouring plants' customer, is located primarily in New England, the Middle Atlantic States, and the Southeast (section IV). The Transcontinental Freight Bureau lists Boston, Mass., Philadelphia, Pa., and Norfolk, Va., as the major rate-taking points for the respective geographic areas (28). This designation greatly simplifies the problem of selecting destination for rail movements. For example, in estimating rail rate differentials one need not be concerned with all the various mill towns and locations in Massachusetts, Rhode Island, and other New England States. Boston is used because it is the rail rate-taking point for New England.

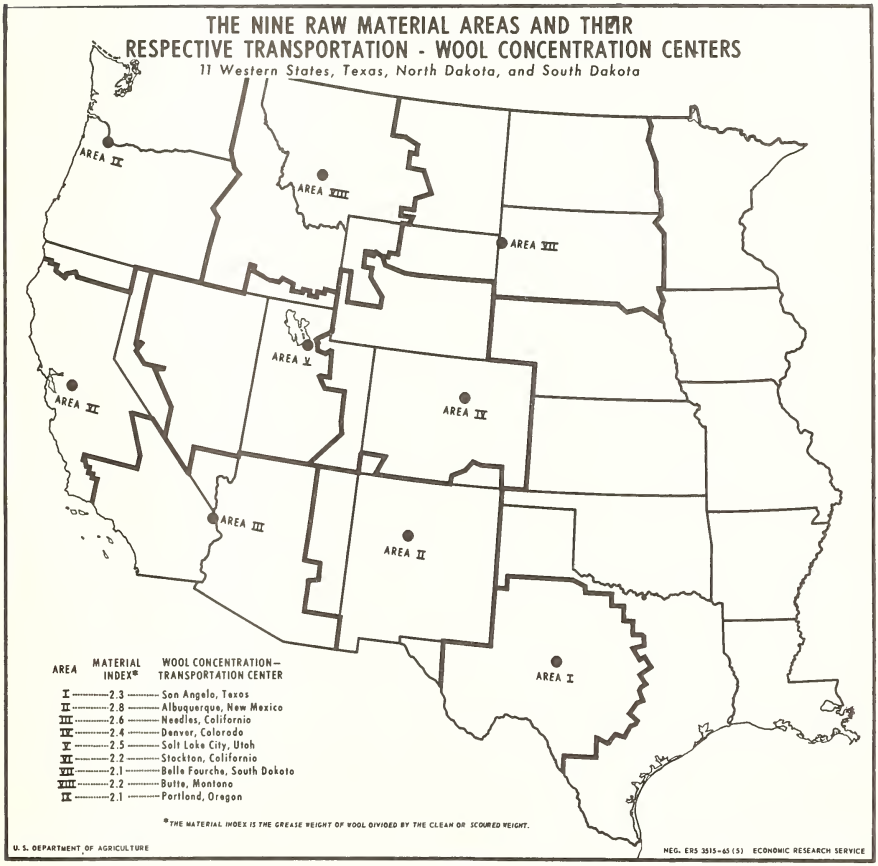
THE NINE RAW MATERIAL AREAS AND THEIR
RESPECTIVE TRANSPORTATION - WOOL CONCENTRATION CENTERS
11 Western States, Texas, North Dakota, and South Dakota
AREA IX
AREA VIII
AREA VII
AREA V
AREA VI
AREA IV
AREA III
AREA II
AREA I
AREA MATERIAL INDEX* WOOL CONCENTRATION—TRANSPORTATION CENTER
I 2.3 San Angelo, Texas
II 2.8 Albuquerque, New Mexico
III 2.6 Needles, California
IV 2.4 Denver, Colorado
V 2.5 Salt Lake City, Utah
VI 2.2 Stockton, California
VII 2.1 Belle Fourche, South Dakota
VIII 2.2 Butte, Montana
IX 2.1 Portland, Oregon
*THE MATERIAL INDEX IS THE GREASE WEIGHT OF WOOL DIVIDED BY THE CLEAN OR SCOURED WEIGHT.
U. S. DEPARTMENT OF AGRICULTURE
NEG. ERS 3515-65 (5) ECONOMIC RESEARCH SERVICE

Figure 16

The same 3 cities are also used as the destination points of motor carrier movements. Although the motor tariffs do not specify rate-taking points, their tariffs are based on the same principle. Point-to-point rates are published in motor carrier tariffs. The wool scouring plant and warehouse operators interviewed, reported that motor carriers, like railroads, would transport wools to any city within a wide geographic area at the same or nearly the same rate. Thus, Boston, Mass.; Philadelphia, Pa.; and Norfolk, Va., are suitable as motor-carrier and rail-carrier rate-taking points for their respective areas.

Rate Assumptions

Certain assumptions in estimating rates for point-to-point movements are necessitated by: Variations in weight minimums now authorized by rail carriers for specific locations, the general lack of transit privileges for all locations along with some variations in those which are authorized, and the amount of wool moved by motor carriers under the agricultural exemption at rates which may deviate from published motor tariff rates. However, the ICC's general policy of nondiscrimination of shippers considerably reduces the restrictions which our assumptions may introduce to the analysis.

For rail movements the most favorable weight minimum commonly authorized, 60,000 pounds, is assumed to be available to all Western shippers if so requested. Rates authorized for this minimum (28) provide the basis for our estimated through rail rates from the wool producing areas to mill centers and for inbound rates from producing areas to Western scouring plants. The outbound weight minimum for scoured wool on rail movements, except for those shipments from the Southwestern Rate Territory, is assumed to be 30,000 pounds--the most favorable, commonly authorized rate. For scoured wool rail shipments from Albuquerque, N. Mex., and San Angelo, Tex., to New England and the Middle Atlantic States the 40,000-pound minimum is used as specified in the tariffs. Selection of rates based upon these assumptions will give estimates of the minimum rail rate obtainable within the existing level of the rate structure. The through rates, combination inbound-outbound rates, and the transit rates are all estimated by the procedures developed in section VII.

The most favorable rate published in motor carrier tariffs, 24,000 pounds, is used in estimating their transportation rates for the various locations. As indicated, motor carriers, unlike rail carriers, do not differentiate between grease and scoured wool for ratemaking purposes. Thus, for a given weight minimum, the same regression coefficient may be used for computing both inbound and outbound movements (table 26, page 76).

Also, as indicated, estimation of motor carrier rates on the basis of published tariffs tends to bias the analysis somewhat in favor of rail carriers. The motor carrier rates in this analysis, then, may be considered maximum rates and used as a basis for negotiating exempt rates for specific wool movements.

Transit rates for motor carrier shipments of wool are not included in the analysis. The common requirement of transit privileges that both inbound and outbound shipments be made by the same carrier greatly reduces the application of such privileges to wool warehouses and scouring plants. Wool producers and local ICC exempt truckers transport most of the inbound shipments to local

warehouses and, to a lesser extent, scouring plants, while ICC regulated carriers and railroads handle the bulk of the outbound movements.

Wool Shrinkage Assumptions

The estimation of inbound-outbound rates and transit rates also requires assumptions relating to the shrinkage or yield of the wools involved because wools vary widely in shrinkage and there is no way to know what the shrinkage actually will be for those wools which may be scoured at a given plant. Average shrinkage for each of the 9 production areas has been estimated, based on wool quality and yield data by States, assembled in 1946 when virtually all the domestic wool clip was purchased by the Commodity Credit Corporation (36). It is assumed that any given plant will receive a cross section of the wools produced within its trade area.

Estimated shrinkages range from 51.6 percent for Oregon and Washington wools (area IX) to 64.5 percent for wools produced primarily in New Mexico (area II), and indicate an expected weight loss of nearly 100 million pounds in scouring the annual wool production of the 9 areas. These estimates of shrinkage may be slightly high because wool improvement programs underway in some of the Western States since 1946 have concentrated largely on increasing staple length and decreasing shrinkage. To the extent that the shrinkage estimates of a particular area might be high, the analysis will overestimate the feasibility of scouring such wools at a Western plant.

The Results

The grade, staple, and volume of wool produced within each of the 9 "raw material" areas was computed from data presented in section II. Five transportation rates were computed from each of the 9 wool concentration-transportation cities representing the production areas to the 3 cities representing consumption areas. Through rates and combination rates were computed for both motor and rail carriers; the combination being useful if scouring intransit privileges are not available. An intransit rate was computed for rail carriers. In addition, transportation rates were computed for scouring Western wools at 3 wool marketing centers in the Midwest: Columbus, Ohio; Kansas City, Mo.; and Minneapolis, Minn.

When the transportation rates and wool supply data were computed, it was obvious that Portland, Oreg. (representing area IX) and Needles, Calif., (representing area III) could be omitted from further analysis. Both are at a distinct transportation disadvantage for scouring any wool produced outside their respective areas when the scoured product is to be shipped to any of the 3 Eastern mill locations selected as destination points. There does not appear to be a sufficient quantity of grease wool available within the areas to justify additional scouring operations. Most of the wool produced within area IX is presently scoured and consumed by local mills. There are no scouring facilities presently located within area III but only 6 million pounds of grease wool are produced there--some 4 million in southern California and 2 million in Arizona.

As an example, the transportation advantages of Denver, Colo., (representing area IV) will be discussed here as a possible scouring location. The same type of comparative analysis is applicable to all other selected locations except for areas III and IX noted above. Transportation rates to Eastern mill points have been computed for a scouring plant at Denver, Colo., (table 27) and for the other Western and Midwestern cities previously mentioned (appendix D) along with the volume, grade, and staple of the wool produced in all 9 "raw material" areas (table 28). If through shipments of grease wool from the raw-material areas to Eastern mill points were the only alternative to scouring in Denver, the information presented in table 26 would be sufficient to evaluate the opportunity for a Denver scouring plant to obtain wool through lower transportation costs. But scouring may be performed at other locations and its effect on the feasibility of scouring wools in Denver must also be considered. The transportation rates for scouring plants at other Western and Midwestern cities presented in appendix D provide the necessary information to evaluate the effect of alternative scouring sites.

Table 27 indicates that a plant in the vicinity of Denver, scouring wools produced in 6 of the 9 raw material areas, might have definite transportation advantages. Information presented in table 27 indicates further that any transportation advantage from scouring wools in Denver which were produced in the 3 other raw material areas (San Angelo, Tex.; Albuquerque, N. Mex.; and Stockton, Calif.) would depend entirely upon the availability of rail intransit scouring privileges. But, look a little closer at each of the areas utilizing the rate information presented in appendix D and the scouring plant information presented in section VI.

Scouring plants located in area IV (represented by Denver, Colo.) would naturally have a definite transportation advantage for the some 27 million pounds of shorn grease wool produced within the area (table 27). It is assumed that the wool produced in area IV will yield about 41 percent (material index= 2.4). Scouring these wools locally would result in considerable savings regardless of the type of carrier or which Eastern mill point was the destination. The greatest advantage could be obtained by utilizing motor carriers for the scoured wool shipments of locally produced wool. The advantage of motor carriers over rail carriers for hauling scoured wool from area IV ranges from the grease wool equivalent of 10 cents per hundredweight for shipments to New England to 15 cents per hundredweight for shipments to the Middle Atlantic States. The advantage of transporting scoured wool by truck over the most advantageous method (rail) of making through shipment of grease wool ranges from $1.10 per hundredweight for shipments to the Middle Atlantic States to $1.13 per hundredweight for New England shipments (table 27).

It may be noted that the rail rate for scouring intransit is not shown in table 27 for wools produced and to be scoured within area IV. This is because it is assumed that wool grown within the area would be so nearly concentrated in Denver warehouses as to make inbound rail movements to the warehouse impractical. Thus, scouring intransit privileges are not applicable to wool shipments originating within the area. This assumption is supported by the Western scouring plant operators who reported that only 1 percent of the inbound movements to their plants were by rail. Thus, the data indicate that the transportation cost of moving the Colorado, eastern Utah, and southern Wyoming wool clip to Eastern mill centers may be reduced more than 50 percent by scouring the wools prior to shipment.

Table 27.--Estimated grease wool equivalent transportation rates per 100 pounds, by type of carrier, for a wool scouring plant at Denver, Colo. by selected origin and destination, 1965

Origin and destination	Motor carrier		Rail carrier		
	Through rate	Combination rate	Through rate	Combination rate	Transit rate
	Cents	Cents	Cents	Cents	Cents
San Angelo to:					
Boston	239	205	140	224	125
Philadelphia	211	193	128	219	121
Norfolk	200	196	113	220	119
Albuquerque to:					
Boston	255	166	149	185	106
Philadelphia	227	156	140	180	103
Norfolk	229	159	132	182	102
Needles to:					
Boston	310	213	227	235	191
Philadelphia	282	202	214	229	185
Norfolk	283	206	209	231	187
Denver to:					
Boston	230	96	209	106	--
Philadelphia	202	84	194	99	--
Norfolk	210	88	199	102	--
Salt Lake City to:					
Boston	274	177	227	205	174
Philadelphia	249	166	214	198	166
Norfolk	257	169	209	201	170
Stockton to:					
Boston	344	264	227	270	209
Philadelphia	319	252	214	263	202
Norfolk	327	255	209	266	204
Belle Fourche to:					
Boston	227	188	210	215	178
Philadelphia	209	175	189	208	172
Norfolk	215	178	209	210	174
Butte to:					
Boston	280	220	227	242	193
Philadelphia	256	207	214	234	186
Norfolk	268	210	209	232	189

Table 28.--Quantity, grade, and staple length of shorn grease wool produced in 9 raw material areas selected for study as wool scouring plant locations in the 11 Western States and Texas, 1955 and 1962-64

Wool producing areas by States and raw material areas, 1/ and location of hypothetical scouring plants 2/	Grade and staple code	Shorn grease wool production			
		1955		1962-64 3/	
		1,000 lbs.	Percent	1,000 lbs.	Percent
Area I (San Angelo, Tex.)					
Texas:					
1	A2	9,740	21.6	10,424	26.2
2	A1	32,382	71.9	28,411	71.3
F	--	264	.6	115	.3
G	--	2,636	5.9	895	2.2
All	--	45,022	100.0	39,845	100.0
Area II (Albuquerque, N. Mex.)					
New Mexico:					
1	A1	4,759	33.7	4,322	36.4
2	A-B1	2,475	17.5	2,321	19.6
3	A-B2	2,035	14.4	1,557	13.1
4	B2	543	3.9	228	1.9
F	--	735	5.2	124	1.1
G	--	757	5.4	750	6.3
Total	--	11,304	80.1	9,302	78.4
Arizona:					
2	A2	282	2.0	255	2.2
3	B2-C2	685	4.8	1,101	9.3
G	--	337	2.4	38	.3
Total	--	1,304	9.2	1,394	11.8
Colorado:					
2	B1-C2	107	.8	158	1.3
4	B-C2	1,104	7.8	827	7.0
5	A-B-C	86	.6	45	.4
Total	--	1,297	9.2	1,030	8.7
Texas:					
2	A1	103	.7	95	.8
G	--	107	.8	39	.3
Total	--	210	1.5	134	1.1
All	--	14,115	100.0	11,860	100.0
Area III (Needles, Calif.)					
Arizona:					
1	A2	214	3.9	819	13.6
2	A2	165	3.0	400	6.6
3	B2-C2	193	3.5	300	5.0
F	--	3	.1	1	4/
G	--	1,127	20.8	559	9.3
Total	--	1,702	31.3	2,079	34.5
California:					
8	A-B2	2,226	41.0	2,401	39.8
9	C-D2	41	.8	52	.8
10	A-B2	1,246	23.0	849	14.1
F	--	114	2.1	620	10.3
G	--	93	1.7	32	.5
Total	--	3,720	68.6	3,954	65.5

See footnotes at end of table.

Continued --

Table 28.--Quantity, grade, and staple length of shorn grease wool produced in 9 raw material areas selected for study as wool scouring plant locations in the 11 Western States and Texas, 1955 and 1962-64--Continued

Wool producing areas by States and raw material areas, 1/ and location of hypothetical scouring plants 2/	Grade and staple code	Shorn grease wool production			
		1955		1962-64 3/	
		1,000 lbs.	Percent	1,000 lbs.	Percent
Area III (Con.)					
Nevada:					
G	--	2	.1	0	4/
Total	--	2	.1	0	4/
All	--	5,424	100.0	6,033	100.0
Area IV (Denver, Colo.)					
Colorado:					
1	A1-B2-C	3,086	11.4	4,241	15.5
2	B1-C2	1,032	3.8	1,029	3.8
3	B1-B2	344	1.3	303	1.1
4	B-C2	926	3.4	796	2.9
5	A-B-C	1,493	5.5	941	3.4
6	B-C	404	1.5	463	1.7
7	A-B1	1,234	4.6	833	3.0
F	--	2,053	7.6	3,583	13.1
Total	--	10,572	39.1	12,189	44.5
Utah:					
3	A2-B-C2	676	2.5	390	1.4
5	B-C2	271	1.0	391	1.4
6	A-B2	1,335	4.9	953	3.5
7	A-B2	1,274	4.7	1,313	4.8
Total	--	3,556	13.1	3,047	11.1
Wyoming:					
4	B-C2	2,099	7.7	1,900	6.9
5	A1-B1-C1	4,173	15.4	3,881	14.2
6	B1-C1	1,507	5.6	1,353	4.9
7	A1	5,178	19.1	5,056	18.4
Total	--	12,957	47.8	12,190	44.4
All	--	27,085	100.0	27,426	100.0
Area V (Salt Lake City, Utah)					
Utah:					
1	A-B2	1,587	11.5	898	9.5
2	A-B2	2,212	16.0	1,960	20.7
3	A2-B-C2	3,446	24.9	2,565	27.2
4	A2-B-C2	1,086	7.9	915	9.7
5	B-C2	221	1.6	308	3.3
7	A-B2	502	3.6	337	3.6
Total	--	9,054	65.5	6,983	74.0
Idaho:					
1	C-D1	1,056	7.6	665	7.1
2	B-C2	856	6.2	117	1.2
Total	--	1,912	13.8	782	8.3
Nevada:					
3	A-B2	926	6.7	652	6.9
4	A-B2	1,004	7.3	600	6.4
5	A-B2	856	6.2	420	4.4
G	--	73	.5	3	4/
Total	--	2,859	20.7	1,675	17.7
All	--	13,825	100.0	9,440	100.0

See footnotes at end of table.

Continued--

Table 28.--Quantity, grade, and staple length of shorn grease wool produced in 9 raw material areas selected for study as wool scouring plant locations in the 11 Western States and Texas, 1955 and 1962-64--Continued

Wool producing areas by States and raw material areas, 1/ and location of hypothetical scouring plants 2/	Grade and staple code	Shorn grease wool production			
		1955		1962-64 3/	
		1,000 lbs.	Percent	1,000 lbs.	Percent
Area VI (Stockton, Calif.)					
California:					
1	C-D1	366	2.3	503	4.1
2	C2	1,514	9.4	1,572	12.7
3	A2	796	4.9	639	5.2
4	B2	391	2.4	329	2.7
5	A-B2	3,430	21.2	2,710	21.9
6	B-C2	3,085	19.1	2,044	16.5
7	A2	2,365	14.6	1,298	10.5
8	A-B2	2,789	17.3	2,432	19.6
9	C-D1	186	1.2	261	2.1
G	--	2	.1	10	.1
Total	--	14,924	92.5	11,798	95.4
Nevada:					
1	A2	267	1.6	75	.6
2	A2	684	4.2	453	3.6
5	A-B2	266	1.6	47	.4
G	--	2	.1	0	4/
Total	--	1,219	7.5	575	4.6
All	--	16,143	100.0	12,373	100.0
Area VII (Belle Fourche, S. Dak.)					
Montana:					
2	A-B-C	1,136	4.2	743	2.3
3	B-C	1,146	4.3	1,111	3.4
4	A-B	2,734	10.2	2,730	8.4
5	A-B	1,792	6.7	1,838	5.6
Total	--	6,808	25.4	6,422	19.7
Wyoming:					
1	A-B2	1,244	4.6	1,519	4.6
2	A-B2	2,214	8.3	3,025	9.3
3	A2-B2	2,332	8.7	2,305	7.0
Total	--	5,790	21.6	6,849	20.9
North Dakota	5/	4,508	16.8	5,160	15.8
South Dakota	5/	9,718	36.2	14,240	43.6
All	--	26,824	100.0	32,671	100.0
Area VIII (Butte, Mont.)					
Idaho:					
1	C-D1	4,811	27.0	2,727	17.6
2	B-C2	3,536	19.9	5,337	34.3
G	--	125	.7	84	.5
Total	--	8,472	47.6	8,148	52.4
Montana:					
1	B-C-D	607	3.4	410	2.6
2	A-B-C	5,847	32.9	4,591	29.6
3	B-C	2,275	12.8	1,770	11.4
G	--	16	.1	7	4/
Total	--	8,745	49.2	6,778	43.6

See footnotes at end of table.

Continued--

Table 28.--Quantity, grade, and staple length of shorn grease wool produced in 9 raw material areas selected for study as wool scouring plant locations in the 11 Western States and Texas, 1955 and 1962-64--Continued

Wool producing areas by States and raw material areas, 1/ and location of hypothetical scouring plants 2/	Grade and staple code	Shorn grease wool production			
		1955		1962-64 3/	
		1,000 lbs.	Percent	1,000 lbs.	Percent
Area VIII (Con.)					
Wyoming:					
3	A2-B2	566	3.1	598	3.9
4	B-C2	7	.1	14	.1
Total	--	573	3.2	612	4.0
All	--	17,790	100.0	15,538	100.0
Area IX (Portland, Oreg.)					
California:					
1	C-D1	12	.1	12	.1
4	B2	271	2.8	263	3.3
Total	--	283	2.9	275	3.4
Oregon:					
1	A2-B-C2	2,492	25.4	1,300	16.1
2	A2-B-C2	1,340	13.7	883	11.0
3	C-D1	1,442	14.7	2,008	24.9
4	C-D1	797	8.1	728	9.0
5	E	652	6.6	781	9.7
Total	--	6,723	68.5	5,700	70.7
Washington:					
1	D1	90	.9	232	2.9
2	B-C1	1,888	19.3	1,236	15.3
3	C2	154	1.6	72	.9
4	C3	636	6.5	512	6.4
G	--	34	.3	30	.4
Total	--	2,802	28.6	2,082	25.9
All	--	9,808	100.0	8,057	100.0

1/ See figure 1, p. 9.
2/ See figure 10, p. 85.
3/ Two year average. 1963 National Wool Act data represented only 9 months and were omitted.
4/ Less than 0.05 percent.
5/ Data not available relating to wool production areas and wool quality.

All of the 27 million pounds produced within the area, however, would not be available to a new plant. A large proportion of this is of sufficient length to be processed on the worsted system and the purchasers may desire to have such wool scoured in the East. In addition, a 1-train scouring plant is presently operating in Colorado and another 1-train plant is sitting idle in southern Wyoming. If the "need" arose, these 2 plants, whose facilities are already in place, could probably scour 12 to 15 million pounds annually. Other established plants in the West, particularly Texas, may also provide considerable competition for area IV wools, even though they are at a transportation disadvantage. Texas plants scoured nearly a million pounds of Colorado and Utah wool in 1960.

A plant located in or around Denver, Colo., would have some transportation advantage for wools produced in area III (represented by Needles, Calif.) if the alternative were through-shipments of grease wool (table 27). Some 6 million pounds are produced in area III and much of it is short-staple lamb's wool for which the wool trade is more likely to consider Western scouring. However, some of this wool is presently being scoured in Texas plants and at a greater transportation advantage than Denver can offer. Denver's advantage over through-shipments of grease wool ranges from 22 to 36 cents per hundredweight, grease basis for rail, intransit scouring. But scouring in San Angelo has an advantage of 37 to 48 cents per hundredweight for intransit rail shipments. San Angelo cannot effectively compete with Denver for motor carrier shipments of area III wools (appendix D). The data available indicate that all California wool shipped to Texas for scouring was transported by motor carriers. But the reduced rail rates authorized in the fall of 1963 will likely cause some shift to railroads and, to the extent that this happens, San Angelo will be more competitive than Denver for wools produced in Arizona and southern California.

Area V, represented by Salt Lake City, Utah, appears to be a good source of grease wool for Denver scouring plants. More than 9 million pounds of wool are produced within the area including some wools destined for the woolen industry (table 28). Less than 0.5 million pounds of these wools were scoured in the West (table 11, p. 25). Scouring facilities do exist in and around Salt Lake City, Utah, but they are limited and in 1960 were not being employed in commission scouring. However, excess scouring capacity for the mill owners did exist and a possible change in their scouring policy should not be completely ruled out.

Except for Salt Lake City, Denver has an edge over the other locations studied for scouring wool produced in area V when motor carriers are utilized. Butte, Mont. is equally competitive for area V wools if railroads are used and intransit scouring privileges are available at both locations. Albuquerque is equally competitive for those rail shipments destined for the Southeast (Norfolk, Va.). If scouring intransit privileges are not available but railroads are to haul the wool, Butte, Mont., has the advantage. But motor carriers offer the greatest potential savings for area V wools, and Denver has the advantage when motor carriers are used (table 27).

Area VII wools (represented by Belle Fourche, S. Dak.) also holds some promise for a scouring plant located in or around Denver. About 33 million pounds of wool are produced within the area (table 28), but one should not be too optimistic about scouring these wools in the West. None of the 36 million pounds of wool scoured in the West in 1959 was produced in the Dakotas, (table 11, p. 25).

While no data are present on the grade and staple of North and South Dakota wools, they are some of the better wools produced in the United States and are largely consumed by the worsted industry.

No wool scouring facilities are presently located within area VII and if some of these wools were to be scoured in the West, Denver and Albuquerque, N. Mex., would offer the same transportation advantages, assuming rail intransit scouring privileges were available to both. If such privileges were not authorized, only motor carrier shipments through Denver would offer any transportation savings over through-shipment of the grease wool (table 27).

Area VIII (represented by Butte, Mont.) is another potential supply area for a Denver wool scouring plant. This area includes Montana, most of Idaho, and northern Wyoming and produces some 16 million pounds of wool. A wide variety of wools are produced and any generalizations about their grade and staple would be more misleading than helpful. No scouring facilities and few wool warehouses are located within the area.

Both Belle Fourche, S. Dak., and Salt Lake City, Utah, offer a greater transportation savings than Denver for scouring wools produced within area VIII. But, as indicated previously, no scouring facilities are presently located in or around Belle Fourche and those in Utah are of limited capacity and have not been available for commission scouring. Thus, there appears to be an opportunity to scour area VIII wools in Denver. The greatest savings would range from 20 to 34 cents per hundredweight (grease basis) if rail scouring intransit privileges were utilized. The combination rail rate is higher than the through grease wool rate. The combination motor carrier rate offers a savings of only 7 cents per hundredweight to Boston and Philadelphia and exceeds the through rail rate for grease wool on shipments destined for the Southeast (appendix D).

It is doubtful that a scouring plant in or around Denver could effectively compete for wools produced in area I (represented by San Angelo, Tex.), area II (represented by Albuquerque, N. Mex.), or area VI (represented by Stockton, Calif.).

Nearly 40 million pounds of wool are produced within area I (table 28) but a large wool scouring industry already exists in Texas and these local plants have a definite edge on plants outside the area. Denver's only opportunity to effect any transportation savings would be on shipments destined for New England or the Middle Atlantic States, if rail scouring-intransit privileges were available, and if the only alternative was through-shipments of grease wool (table 27).

It is most unlikely that area I wools would be sent to Denver for scouring when facilities are already available within area I and the utilization of local facilities will yield the maximum transportation savings. The scouring plants operating within area I in 1960 were already scouring more than 18 million pounds of Texas wools annually. Additional scouring trains have since been added to existing plants and 2 new plants have been built within area I since 1960. One of the new plants is located in San Angelo and the other in Del Rio. Both are presently 1-train operations. The Del Rio plant is located in the heart of a short-wool area where twice-a-year shearing is common and the some 10 million pounds of wool produced are destined largely for the woolen industry.

The 2 new plants and the existing facilities in Brady and San Marcos, Tex., brings the total number of scouring trains in area I during 1964 to 14. If these trains were utilized at full capacity, all the wool produced within area I could be scoured in less than 6 months.

A similar situation exists for those wools produced in area II which are primarily New Mexico wools. Nearly 12 million pounds are produced within the area (table 28) but Texas plants have the advantage over Denver unless the wools are shipped under transit authorization by rail to Denver for scouring and then sent to New England or the Middle Atlantic States. Even under these conditions Denver's advantage over Texas plants ranges only from 4 to 7 cents per hundredweight (appendix D).

More than 25 percent of the wool produced within area II is in southeastern New Mexico, about 200 miles from Albuquerque and much closer to San Angelo than Denver. No scouring facilities are presently located within area II but more than 5 million pounds of New Mexico wool was scoured at Texas plants (table 11, p. 25).

Neither Denver nor the established Texas plants can effectively compete for the 12 million pounds of wools produced in area VI, which is primarily northern California, unless rail intransit scouring privileges are available. And if transit privileges are available, San Angelo has a slight advantage on shipments to all 3 Eastern mill areas (table 27).

The lack of scouring facilities in the Midwest is important to Denver and all other Western scouring locations. From a transportation standpoint, a scouring plant in Kansas City would yield as great or greater savings than one in Denver for wools produced in areas I, II, III, VII, and VIII. Columbus, Ohio would compete with Denver for wools produced in area I, particularly if the mill point was in the Southeast. Minneapolis, Minn. would have a competitive advantage over Denver for those wools produced in areas I, VII, and VIII, regardless of mill destination (table 27).

Summarily, a scouring plant in or around Denver along with other plants in area IV, would have a transportation advantage for some 27 million pounds of wool produced within the area. But sufficient facilities to scour 12 to 15 million pounds are already located in the area. Scouring facilities presently exist in Utah which have an advantage over Denver for the 25 million pounds of wools produced in area V and VIII. But these facilities are limited and were not available for commission scouring. Area VII, with 33 million pounds, also holds some promise for a scouring plant located in Denver. Established Texas plants have as great or greater transportation advantage than Denver for the some 70 million pounds of wool produced in areas I, II, III, and VI. Area IX is not considered a supply area for any plant outside Washington and Oregon because the production is largely consumed by local mills.

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X. APPENDIX A

AN INTRANSIT PRIVILEGE APPLICABLE TO GREASE WOOL SHIPMENTS BY RAIL CARRIERS

In general, the transit privilege that is in effect concerns wool grading and storage in transit. The following is a brief description of an authorized sorting, coring, grading, or storage transit privilege.

General application.--When provided for in the published tariff rates and subject to rules and regulations provided in the agreement, shipments of grease wool in carloads or mixed carloads, from a point of origin to final destination, may be stopped in transit for sorting, coring, grading, or storage (at specific stations).

Specific application.--Defines specific geographic areas and connecting carriers to which the privileges are applicable.

Charges.--Total charges are derived from the through rate in effect on the date of the original shipment, from point of origin to final destination, plus the stopping charge. Respondents reported that with the transit privileges presently in effect, the amount of this charge ranged from 7 cents to 32 cents per 100 pounds. The variation depended largely on the services to be performed and the extent to which the load was permitted to deviate from the main line.

Transfer of tonnage or ownership.--This section describes the manner in which the commodity may be transferred between facilities or individuals.

Although not described by warehouse operators, transit privileges for the concentration of wool have been in effect for a number of years. The principles of this privilege are basically the same as those for sorting, grading, or storing. However, a brief description of its application may be of value to this discussion.

Application.--Shipments of wool in carloads or less than carloads to stations for which rates are provided in the tariff may be stopped at specific stations for concentration and reshipped in carloads (with exceptions).

Less than carload shipments into stations.--The shipment into concentration stations may be in less than carload quantity when its origin and the concentration station are both located on the same line or lines under the same management or control.

Time limit.--Shipments must be forwarded from concentration stations within 1 year from date of receipt of inbound shipment at that station as shown by the freight bill, and the carrier hauling the shipments to concentration stations shall issue bills of lading for the outbound shipment from the concentration station and adjust the inbound charges.

With minor revisions the transit privileges that have been described are applicable to all modes of transportation.

XI. APPENDIX B

Rail Carload Rates, by Miles, for Wool and Mohair Shipments Originating Within the Southwest Freight Bureau Territory Including Albuquerque, N. Mex., and Shipped to the Southern Freight Territory or the Official Territory.

I. Applicable Commodities:

A. Wool or mohair, in the grease, in bags or baĺes.

B. Wool or mohair tags, in the grease, in bags or bales.

C. Wool or mohair, scoured and/or combed, in bags or bales.

D. Wool or mohair tags, scoured and/or combed, in bags or bales.

E. Wool or mohair tops, in bags, bales or boxes.

II. Minimum Weight:

A. To the Southern Freight Bureau Territory: 30,000 pounds, and shipments weighing in excess of 30,000 pounds in the same car, not subject to rule 24 or rule 34 of the Uniform Freight Classification.

B. To the Official Territory: 40,000 pounds, and shipments weighing in excess of 40,000 pounds in the same car, not subject to rule 24 or rule 34 of the Uniform Freight Classification.

III. Rates:

Rail Short-line miles	Rates per 100 pounds			
	Grease wool or mohair		Scoured and/or combed wool or mohair	
	On minimum weight	On pounds in excess of minimum weight	On minimum weight	On pounds in excess of minimum weight
	Cents	Cents	Cents	Cents
1 to 5	16.5	11.5	18.5	12.5
6 to 10	18.5	12.5	20.5	13.5
11 to 15	19.5	13.5	22.5	14.5
16 to 20	20.5	14.5	23.5	15.5
21 to 25	21.5	14.5	24.5	16.5
26 to 30	22.5	15.5	25.5	17.5
31 to 35	23.5	16.5	26.5	17.5
36 to 40	24.5	16.5	27.5	18.5
41 to 45	25.5	17.5	28.5	18.5
46 to 50	25.5	17.5	28.5	19.5

Continued--

III. Rates:--Continued

Rail short-line miles	Rates per 100 pounds: Grease wool or mohair: On minimum weight	Grease wool or mohair: On pounds in excess of minimum weight	Scoured and/or combed wool or mohair: On minimum weight	Scoured and/or combed wool or mohair: On pounds in excess of minimum weight
	Cents	Cents	Cents	Cents
51 to 55	26.5	18.5	29.5	20.5
56 to 60	27.5	18.5	30.5	20.5
61 to 65	28.5	19.5	31.5	21.5
66 to 70	28.5	19.5	32.5	21.5
71 to 75	29.5	19.5	32.5	21.5
76 to 80	29.5	20.5	33.5	22.5
81 to 85	30.5	20.5	34.5	23.5
86 to 90	31.5	21.5	35.5	23.5
91 to 95	31.5	21.5	35.5	23.5
96 to 100	32.5	21.5	36.5	24.5
101 to 110	33.5	22.5	37.5	25.5
111 to 120	34.5	23.5	38.5	25.5
121 to 130	35.5	24.5	39.5	26.5
131 to 140	36.5	24.5	41.5	27.5
141 to 150	37.5	25.5	42.5	28.5
151 to 160	38.5	26.5	43.5	28.5
161 to 170	39.5	26.5	44.5	29.5
171 to 180	40.5	27.5	45.5	30.5
181 to 190	41.5	27.5	46.5	30.5
191 to 200	41.5	28.5	47.5	31.5
201 to 210	43.5	29.5	48.5	32.5
211 to 220	43.5	29.5	49.5	33.5
221 to 230	44.5	30.5	50.5	33.5
231 to 240	45.5	30.5	51.5	34.5
241 to 260	47.5	32.5	53.5	35.5
261 to 280	48.5	33.5	54.5	36.5
281 to 300	50.5	34.5	56.5	37.5
301 to 320	52.5	35.5	58.5	39.5
321 to 340	53.5	36.5	60.5	40.5
341 to 360	55.5	37.5	61.5	41.5
361 to 380	56.5	38.5	63.5	42.5
381 to 400	57.5	39.5	65.5	43.5
401 to 420	59.5	40.5	67	44.5
421 to 440	60.5	41.5	69	45.5
441 to 460	61.5	41.5	70	46.5

Continued--

III. Rates:--Continued

Rail short-line miles	Rates per 100 pounds: Grease wool or mohair: On minimum weight	Grease wool or mohair: On pounds in excess of minimum weight	Scoured and /or combed wool or mohair: On minimum weight	Scoured and /or combed wool or mohair: On pounds in excess of minimum weight
	Cents	Cents	Cents	Cents
461 to 480	63.5	43.5	72	47.5
481 to 500	64.5	43.5	73	48.5
501 to 520	65.5	44.5	75	49.5
521 to 540	68	45.5	77	50.5
541 to 560	69	46.5	78	51.5
561 to 580	71	47.5	80	52.5
581 to 600	72	48.5	81	53.5
601 to 620	73	49.5	82	54.5
621 to 640	75	50.5	84	55.5
641 to 660	76	51.5	86	57.5
661 to 680	78	52.5	87	57.5
681 to 700	79	53.5	89	59.5
701 to 720	81	54.5	91	60.5
721 to 740	82	55.5	92	61.5
741 to 760	83	55.5	93	62.5
761 to 780	85	56.5	95	63.5
781 to 800	86	57.5	97	64.5
801 to 825	87	58.5	98	65.5
826 to 850	89	59.5	100	67
851 to 875	90	60.5	101	68
876 to 900	92	61.5	103	69
901 to 925	93	62.5	105	70
926 to 950	94	63.5	106	71
951 to 975	96	64.5	107	72
976 to 1,000	97	65.5	109	73
1,001 to 1,025	99	67	111	74
1,026 to 1,050	100	68	112	75
1,051 to 1,075	101	69	114	76
1,076 to 1,100	103	70	115	77
1,101 to 1,125	104	71	117	78
1,126 to 1,150	105	71	118	79
1,151 to 1,175	107	72	120	80
1,176 to 1,200	108	73	122	82
1,201 to 1,225	110	74	123	83

Continued--

III. Rates:--Continued

Rail short-line miles	Rate per 100 pounds: Grease wool or mohair: On minimum weight	Grease wool or mohair: On pounds in excess of minimum weight	Scoured and/or combed wool or mohair: On minimum weight	Scoured and/or combed wool or mohair: On pounds in excess of minimum weight
	Cents	Cents	Cents	Cents
1,226 to 1,250	111	75	123	84
1,251 to 1,275	113	76	127	85
1,276 to 1,300	114	77	128	86
1,301 to 1,325	115	78	129	87
1,326 to 1,350	117	79	131	88
1,351 to 1,375	118	80	132	89
1,376 to 1,400	119	81	134	90
1,401 to 1,425	121	82	136	91
1,426 to 1,450	122	83	137	92
1,451 to 1,475	123	84	139	93
1,476 to 1,500	125	85	141	94
1,501 to 1,525	126	86	142	95
1,526 to 1,550	127	86	143	96
1,551 to 1,575	129	87	145	97
1,576 to 1,600	131	88	147	98
1,601 to 1,625	132	89	148	99
1,626 to 1,650	133	90	150	100
1,651 to 1,675	135	91	151	101
1,676 to 1,700	136	92	153	102
1,701 to 1,725	138	93	155	103
1,726 to 1,750	139	94	156	104
1,751 to 1,775	140	95	158	106
1,776 to 1,800	142	96	159	107
1,801 to 1,825	143	97	161	108
1,826 to 1,850	144	98	162	109
1,851 to 1,875	146	99	164	110
1,876 to 1,900	147	100	165	111
1,901 to 1,925	149	101	168	112
1,926 to 1,950	150	102	169	113
1,951 to 1,975	151	103	170	114
1,976 to 2,000	153	104	172	115
2,001 to 2,025	154	105	174	116
2,026 to 2,050	155	105	175	117

Continued--

III. Rates:--Continued

Rail short-line miles	Rate per 100 pounds			
	Grease wool or mohair		Scoured and/or combed wool or mohair	
	On minimum weight	On pounds in excess of minimum weight	On minimum weight	On pounds in excess of minimum weight
	Cents	Cents	Cents	Cents
2,051 to 2,075	157	106	177	118
2,076 to 2,100	158	107	178	119
2,101 to 2,125	160	108	180	120
2,126 to 2,150	161	109	181	121
2,151 to 2,175	163	110	183	122
2,176 to 2,200	164	111	184	123
2,201 to 2,250	167	113	187	125
2,251 to 2,300	170	115	191	128
2,301 to 2,350	172	117	194	129
2,351 to 2,400	175	118	197	132
2,401 to 2,450	178	120	200	134
2,451 to 2,500	181	122	203	136
2,501 to 2,550	183	124	206	138
2,551 to 2,600	186	126	209	140
2,601 to 2,650	189	128	213	142
2,651 to 2,700	192	130	216	144
2,701 to 2,750	195	132	219	146
2,751 to 2,800	197	134	222	148
2,801 to 2,850	200	135	225	150
2,851 to 2,900	203	137	228	153
2,901 to 2,950	206	139	231	155
2,951 to 3,000	208	141	234	157

XII. APPENDIX C

AN INTRANSIT SCOURING PRIVILEGE APPLICABLE TO GREASE WOOL SHIPMENTS BY RAIL CARRIERS

Description of a Wool Scouring Transit Privilege

An example of the type of transit privilege that may be authorized for a wool scouring plant located in the producing area may be illustrated in the following manner:

Definition of the Privilege

Wool of carloads, or less than carloads, originating at stations on the named carrier may be scoured at stations on the route of the carrier and reshipped, in carloads, via the named carrier or its connections to interstate points.

Rates and Charges to be Applied

On the inbound shipment to the transit point, the published tariff rate will be applied. When reshipment is made from the transit point, the inbound charge will be adjusted on the basis of the carload rate and minimum weight as in effect on the date of the original shipment, applicable on the commodity forwarded from the transit point, but not less than the through rate, inbound rate to transit point, or outbound rate from the transit point to final destination, whichever is higher, plus the following additional charges:

(1) A transit charge based upon an agreement between shipper and carrier usually in cents per 100 pounds.
(2) An extra charge will be paid for backhaul based on tons per mile of backhaul involved.

Identity of Shipments

Since it is almost impossible to preserve the identity of the commodity at the transit point, the substitution of one commodity for another of the same kind is permitted.

Deduction for Loss or Wastage

After scouring, the scouring plant operator must declare by certification on each inbound freight bill, the exact amount of weight loss of the shipment due to processing. The weight loss will then be deducted from the weight of the inbound shipment and the remaining weight will be entitled to the transit privileges. An exception is usually noted here; i.e., the remaining weight on which the transit privilege will be granted shall not exceed the quantity actually loaded in one outbound car. These excess weights will be treated as nontransit shipments and charges will be assessed at the published rate from transit point to final destination.

Transit Privilege Requirements

Transit privileges are granted only to those shippers who:

(1) Notify the carrier or its representative in writing of their intention to avail themselves of the transit privileges.
(2) Are able to produce evidence of correct weights.
(3) Keep an accurate record of receipts and shipments which are acceptable to the carrier.
(4) Permit an authorized representative of the carrier at any time to have access to all shipment and receipt records in regard to intransit shipments.
(5) Must be willing to make statements as to the validity of any or all of the shipment records.

Any shipper who fails or refuses to keep accurate records or to provide the carrier with prescribed affidavits will be denied transit privileges.

There is also included in the transit privilege a provision for a change of ownership of the wool while it is being processed or warehoused at the transit point. Also, a limit is applied to the time a shipment may be warehoused at the point of transit prior to being forwarded to its final destination.

Table 29.--Estimated grease wool equivalent transportation rates per 100 pounds, by type of carrier, for a wool scouring plant at San Angelo, Tex., by selected origin and destination points, 1965

Origin and destination	Motor carrier		Rail carrier		
	Through rate	Combination rate	Through rate	Combination rate	Transit rate
	Cents	Cents	Cents	Cents	Cents
San Angelo to:					
Boston	239	104	140	77	--
Philadelphia	211	92	128	70	--
Norfolk	200	87	113	66	--
Albuquerque to:					
Boston	255	169	149	126	113
Philadelphia	227	165	140	121	107
Norfolk	229	155	132	113	101
Needles to:					
Boston	310	228	227	202	179
Philadelphia	282	218	214	196	174
Norfolk	283	213	209	192	172
Denver to:					
Boston	230	201	209	190	164
Philadelphia	202	189	194	183	158
Norfolk	210	193	199	179	160
Salt Lake City to:					
Boston	274	254	227	224	192
Philadelphia	249	244	214	217	189
Norfolk	257	247	209	213	184
Stockton to:					
Boston	344	344	227	258	208
Philadelphia	319	332	214	249	202
Norfolk	327	336	209	245	200
Belle Fourche to:					
Boston	227	251	210	213	177
Philadelphia	209	242	189	206	167
Norfolk	215	245	209	201	176
Butte to:					
Boston	280	312	227	258	209
Philadelphia	256	301	214	251	203
Norfolk	268	307	209	247	201

Table 30.--Estimated grease wool equivalent transportation rates per 100 pounds by type of carrier, for a wool scouring plant at Albuquerque, N. Mex. by selected origin and destination points, 1965

Origin and destination	Motor carrier		Rail carrier		
	Through rate	Combination rate	Through rate	Combination rate	Transit rate
	Cents	Cents	Cents	Cents	Cents
San Angelo to:					
Boston	239	195	140	144	126
Philadelphia	211	182	128	140	122
Norfolk	200	183	113	136	119
Albuquerque to:					
Boston	255	91	149	67	--
Philadelphia	227	81	140	63	--
Norfolk	229	82	132	63	--
Needles to:					
Boston	310	186	227	176	160
Philadelphia	282	175	214	172	155
Norfolk	283	176	209	172	153
Denver to:					
Boston	230	185	209	174	152
Philadelphia	202	174	194	170	146
Norfolk	210	175	199	170	148
Salt Lake City to:					
Boston	274	196	227	208	180
Philadelphia	249	185	214	204	174
Norfolk	257	186	209	204	172
Stockton to:					
Boston	344	254	227	227	190
Philadelphia	319	242	214	222	184
Norfolk	327	243	209	222	181
Belle Fourche to:					
Boston	227	245	210	219	177
Philadelphia	209	232	189	214	167
Norfolk	215	233	209	214	177
Butte to:					
Boston	280	248	227	249	202
Philadelphia	256	240	214	244	196
Norfolk	268	240	209	244	193

Table 31.--Estimated grease wool equivalent transportation rates per 100 pounds, by type of carrier, for a wool scouring plant at Salt Lake City, Utah, by selected origin and destination points, 1965

Origin and destination	Motor carrier		Rail carrier		
	Through rate	Combination rate	Through rate	Combination rate	Transit rate
	Cents	Cents	Cents	Cents	Cents
San Angelo to:					
Boston	239	263	140	273	154
Philadelphia	211	252	128	266	150
Norfolk	200	256	113	264	148
Albuquerque to:					
Boston	255	192	149	231	137
Philadelphia	227	183	140	226	134
Norfolk	229	186	132	224	131
Needles to:					
Boston	310	194	227	214	181
Philadelphia	282	184	214	204	174
Norfolk	283	187	209	208	175
Denver to:					
Boston	230	199	209	218	184
Philadelphia	202	188	194	211	177
Norfolk	210	192	199	213	179
Salt Lake City to:					
Boston	274	110	227	110	--
Philadelphia	249	100	214	104	--
Norfolk	257	103	209	102	--
Stockton to:					
Boston	344	228	227	244	200
Philadelphia	319	217	214	235	190
Norfolk	327	221	209	237	192
Belle Fourche to:					
Boston	227	237	210	258	206
Philadelphia	209	225	189	248	197
Norfolk	215	229	209	251	199
Butte to:					
Boston	280	200	227	218	185
Philadelphia	256	189	214	209	176
Norfolk	268	193	209	211	178

Table 32.--Estimated grease wool equivalent transportation rates per 100 pounds, by type of carrier, for a wool scouring plant at Stockton, Calif., by selected origin and destination points, 1965

Origin and destination	Motor carrier		Rail carrier		
	Through rate	Combination rate	Through rate	Combination rate	Transit rate
	Cents	Cents	Cents	Cents	Cents
San Angelo to:					
Boston	239	337	140	296	177
Philadelphia	211	326	128	289	177
Norfolk	200	329	113	287	173
Albuquerque to:					
Boston	255	261	149	240	152
Philadelphia	227	252	140	235	152
Norfolk	229	255	132	233	149
Needles to:					
Boston	310	217	227	207	180
Philadelphia	282	207	214	201	171
Norfolk	283	210	209	199	170
Denver to:					
Boston	230	298	209	273	216
Philadelphia	202	288	194	266	210
Norfolk	210	291	199	264	207
Salt Lake City to:					
Boston	274	241	227	227	189
Philadelphia	249	231	214	221	183
Norfolk	257	235	209	219	181
Stockton to:					
Boston	344	156	227	125	--
Philadelphia	319	145	214	118	--
Norfolk	327	149	209	116	--
Belle Fourche to:					
Boston	227	330	210	330	228
Philadelphia	209	318	189	293	221
Norfolk	215	322	209	290	219
Butte to:					
Boston	280	245	227	262	209
Philadelphia	256	234	214	255	202
Norfolk	268	238	209	253	200

Table 33.--Estimated grease wool equivalent transportation rates per 100 pounds, by type of carrier, for a wool scouring plant at Belle Fourche, S. Dak., by selected origin and destination points, 1965

Origin and destination	Motor carrier		Rail carrier		
	Through rate	Combination rate	Through rate	Combination rate	Transit rate
	Cents	Cents	Cents	Cents	Cents
San Angelo to:					
Boston	239	241	140	233	128
Philadelphia	211	234	128	229	125
Norfolk	200	236	113	240	137
Albuquerque to:					
Boston	255	205	149	216	122
Philadelphia	227	198	140	213	119
Norfolk	229	200	132	221	128
Needles to:					
Boston	310	236	227	242	194
Philadelphia	282	229	214	239	190
Norfolk	283	232	209	248	199
Denver to:					
Boston	230	173	209	196	165
Philadelphia	202	166	194	192	161
Norfolk	210	168	199	202	171
Salt Lake City to:					
Boston	274	197	227	245	194
Philadelphia	249	190	214	241	191
Norfolk	257	192	209	251	200
Stockton to:					
Boston	344	261	227	278	210
Philadelphia	319	252	214	274	206
Norfolk	327	255	209	285	217
Belle Fourche to:					
Boston	227	108	210	114	--
Philadelphia	209	100	189	110	--
Norfolk	215	102	209	121	--
Butte to:					
Boston	280	193	227	215	176
Philadelphia	256	184	214	211	172
Norfolk	268	187	209	222	183

Table 34.--Estimated grease wool equivalent transportation rates per 100 pounds, by type of carrier, for a wool scouring plant at Butte, Mont., by selected origin and destination points, 1965

Origin and destination	Motor carrier		Rail carrier		
	Through rate	Combination rate	Through rate	Combination rate	Transit rate
	Cents	Cents	Cents	Cents	Cents
San Angelo to:					
Boston	239	308	140	298	160
Philadelphia	211	305	128	291	159
Norfolk	200	300	113	289	159
Albuquerque to:					
Boston	255	238	149	262	148
Philadelphia	227	235	140	257	147
Norfolk	229	231	132	255	146
Needles to:					
Boston	310	240	227	245	200
Philadelphia	282	237	214	237	193
Norfolk	283	232	209	239	195
Denver to:					
Boston	230	233	209	241	197
Philadelphia	202	230	194	232	189
Norfolk	210	225	199	234	191
Salt Lake City to:					
Boston	274	189	227	203	175
Philadelphia	249	186	214	195	167
Norfolk	257	181	209	197	169
Stockton to:					
Boston	344	218	227	269	214
Philadelphia	319	214	214	260	203
Norfolk	327	209	209	262	206
Belle Fourche to:					
Boston	227	224	210	246	200
Philadelphia	209	221	189	236	191
Norfolk	215	215	209	238	193
Butte to:					
Boston	280	129	227	125	--
Philadelphia	256	125	214	116	--
Norfolk	268	120	209	118	--

Table 35.--Estimated grease wool equivalent transportation rates per 100 pounds, by type of carrier, for a wool scouring plant at Columbus, Ohio, by selected origin and destination points, 1965

Origin and destination	Motor carrier		Rail carrier		
	Through rate	Combination rate	Through rate	Combination rate	Transit rate
	Cents	Cents	Cents	Cents	Cents
San Angelo to:					
Boston	239	212	140	146	128
Philadelphia	211	200	128	137	123
Norfolk	200	204	113	137	113
Albuquerque to:					
Boston	255	175	149	149	135
Philadelphia	227	165	140	141	132
Norfolk	229	169	135	136	125
Needles to:					
Boston	310	277	227	259	219
Philadelphia	282	266	214	250	214
Norfolk	283	270	209	253	212
Denver to:					
Boston	230	201	209	219	186
Philadelphia	202	189	194	209	180
Norfolk	210	193	199	213	182
Salt Lake City to:					
Boston	274	246	227	252	213
Philadelphia	249	235	214	242	208
Norfolk	257	239	209	245	206
Stockton to:					
Boston	344	322	227	298	236
Philadelphia	319	310	214	287	236
Norfolk	327	314	209	291	236
Belle Fourche to:					
Boston	227	211	210	226	188
Philadelphia	209	198	189	214	178
Norfolk	215	203	209	218	188
Butte to:					
Boston	280	262	227	259	215
Philadelphia	256	249	214	248	209
Norfolk	268	254	209	252	207

Table 36.--Estimated grease wool equivalent transportation rates per 100 pounds, by type of carrier, for a wool scouring plant at Kansas City, Mo., by selected origin and destination points, 1965

Origin and destination	Motor carrier		Rail carrier		
	Through rate	Combination rate	Through rate	Combination rate	Transit rate
	Cents	Cents	Cents	Cents	Cents
San Angelo to:					
Boston	239	182	140	200	111
Philadelphia	211	169	128	193	105
Norfolk	200	173	113	195	103
Albuquerque to:					
Boston	255	179	149	195	109
Philadelphia	227	169	140	190	105
Norfolk	229	171	135	191	101
Needles to:					
Boston	310	238	227	229	189
Philadelphia	282	227	214	223	184
Norfolk	283	230	209	224	182
Denver to:					
Boston	230	166	209	191	163
Philadelphia	202	154	194	185	152
Norfolk	210	157	199	187	154
Salt Lake City to:					
Boston	274	213	227	224	186
Philadelphia	249	202	214	218	180
Norfolk	257	205	209	219	178
Stockton to:					
Boston	344	293	227	285	217
Philadelphia	319	280	214	278	212
Norfolk	327	284	209	280	209
Belle Fourche to:					
Boston	227	194	210	214	171
Philadelphia	209	180	189	207	161
Norfolk	215	184	209	209	170
Butte to:					
Boston	280	244	227	244	195
Philadelphia	256	231	214	237	189
Norfolk	268	234	209	239	187

Table 37.--Estimated grease wool equivalent transportation rates per 100 pounds, by type of carrier, for a wool scouring plant at Minneapolis, Minn., by selected origin and destination points, 1965

Origin and destination	Motor carrier		Rail carrier		
	Through rate	Combination rate	Through rate	Combination rate	Transit rate
	Cents	Cents	Cents	Cents	Cents
San Angelo to:					
Boston	239	227	140	227	123
Philadelphia	211	217	128	225	118
Norfolk	200	222	113	229	115
Albuquerque to:					
Boston	255	237	149	222	128
Philadelphia	227	228	140	220	125
Norfolk	229	232	135	224	119
Needles to:					
Boston	310	276	227	253	207
Philadelphia	282	266	214	252	202
Norfolk	283	271	209	255	200
Denver to:					
Boston	230	190	209	203	168
Philadelphia	202	180	194	201	162
Norfolk	210	185	199	204	164
Salt Lake City to:					
Boston	274	226	227	234	195
Philadelphia	249	217	214	232	189
Norfolk	257	221	209	236	187
Stockton to:					
Boston	344	306	227	294	225
Philadelphia	319	295	214	292	219
Norfolk	327	300	209	296	217
Belle Fourche to:					
Boston	227	179	210	202	166
Philadelphia	209	168	189	198	156
Norfolk	215	173	209	202	166
Butte to:					
Boston	280	219	227	226	188
Philadelphia	256	208	214	224	182
Norfolk	268	213	209	228	180